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TYPES OF KALE GROWN IN NEW ZEALAND.

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A CERTAIN amount of misunderstanding having existed in connection with the nomenclature of the several kales used in New Zealand, an investigation has been made recently by the Plant Research Station with the purpose of defining the various types. Samples were collected from all possible sources, seed sown in the nursery, and seedlings transplanted 2 ft. apart each way. This spacing enabled each plant to have reasonable scope for development and facilitated the detection of points of difference. Material collected comprised: (1) Rape-kale, (2) Buda kale, (3) thousand-headed kale, and (4) chou moellier, or marrow-stem kale.

RAPE-KALE.

Rape-kale is not used extensively in New Zealand, but there are certain districts in which it would be grown were it possible to place greater reliance on its type purity. There are two very distinct types. One, described as an early giant form, bears smooth leaves, the other, a late or long-standing form, has leaves which are very much curled. (Figs. 1 and 2.) In neither case is there any very definite stem development.

Field evidence, which is confirmed in our trials, indicates that the late or curly-leaved type is not very palatable to sheep. At this Station during the past two years it has not been as productive as the early type, and once cut back has given practically no second growth. The samples of the late type sent in for trial have proved, however, to be pure with little or no variation. On the other hand, the early type is generally mixed, and contains a proportion of late curly-leaved plants and a large number of intermediate forms. (Fig. 3.) The yield and recovery of the true smooth-leaved early type has been exceptionally good, but the intermediate and curly-leaved plants, present as impurities, detract from its value in that they are more or less similar in behaviour to the late type.

FIG. 1. EARLY GIANT RAPE-KALE.

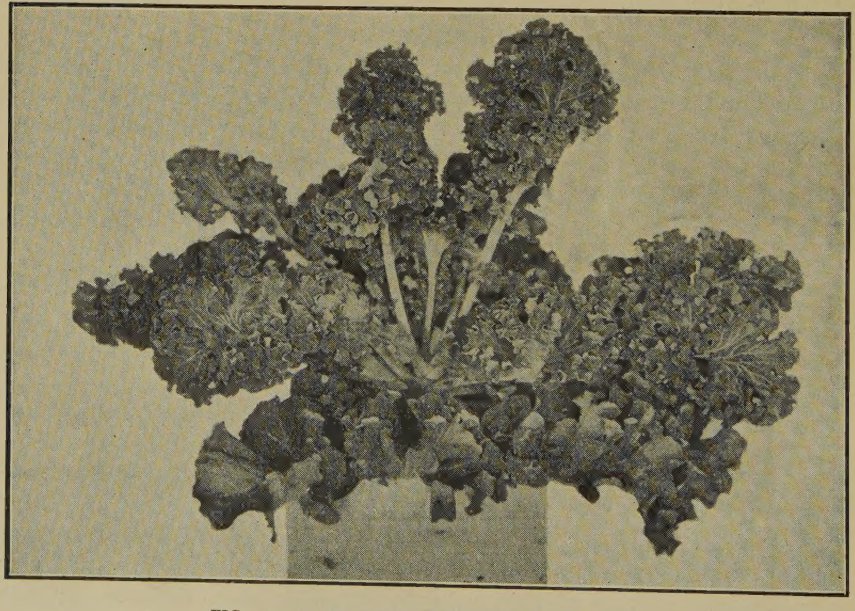

FIG. 2. LATE LONG-STANDING RAPE-KALE.

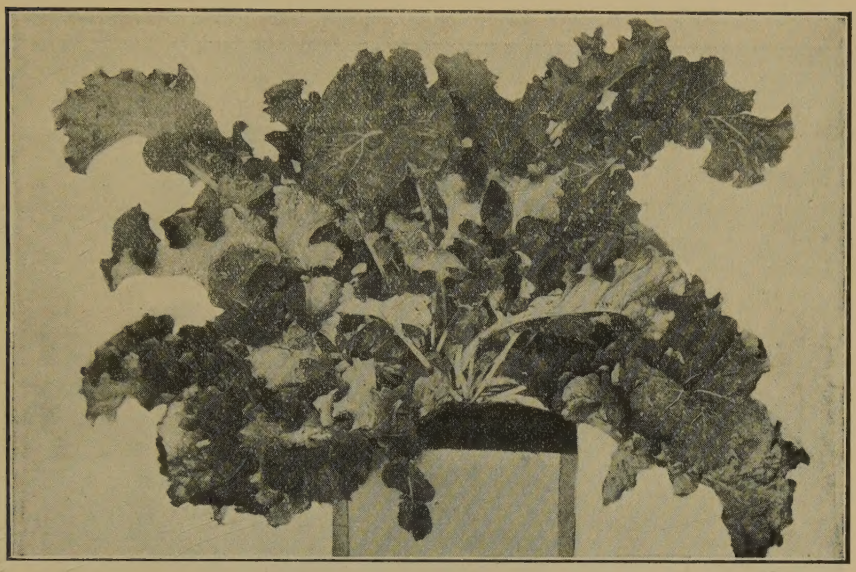

FIG. 3. INTERMEDIATE FORM OF RAPE-KALE.

Numerous intermediate forms appear in the early rape-kale, indicating that the type is not fixed.

Buda Kale.

There is reason to doubt whether the Buda kale of to-day is the same as the fodder crop which years ago gained such popularity in certain parts of the North Island under this name. Considerable difference of opinion exists as to the type of plant that should be regarded as the true Buda kale. Two very distinct types have been sent in by merchants for trial. So far as we can judge from appearance, behaviour, and chemical analysis, one type is identical with rape, and would be included without any hesitation as Type 2 rape in our classification. (See "Types of Rape used in New Zealand," this *Journal*, October, 1931, page 255.) This Buda kale is illustrated in Fig. 4. The seed is identical with that of rape, and the following direct comparisons have been made which show a striking degree of similarity in other respects.

Table 1.—Comparisons between the Rape-like Buda Kale and Rape.

Points of Comparison.	Rape-like Buda Kale.	Type 2 Rape.
Dry matter percentage	9·73	11·29
Ether extract (Expressed as a percentage of dry matter)	5·16	5·09
Fibre .. .. (Expressed as a percentage of dry matter)	10·74	10·73
Protein .. .. (Expressed as a percentage of dry matter)	29·90	29·20
Nitrogen-free extract (Expressed as a percentage of dry matter)	40·88	42·48
Ash .. .. (Expressed as a percentage of dry matter)	13·32	12·50
Leaf blade percentage	35	37
Leaf stalk and mid-rib percentage ..	65	63

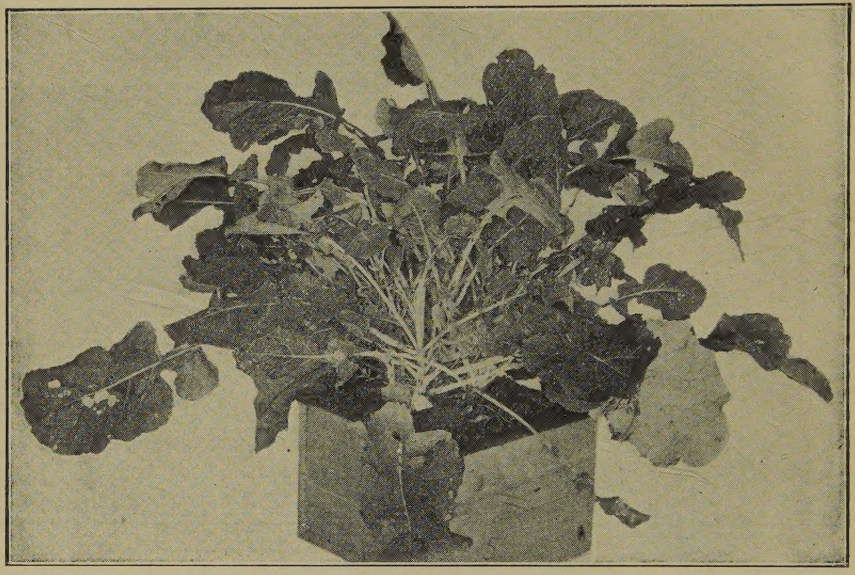

FIG. 4. A FORM OF BUDA KALE WHICH IS IDENTICAL WITH RAPE.

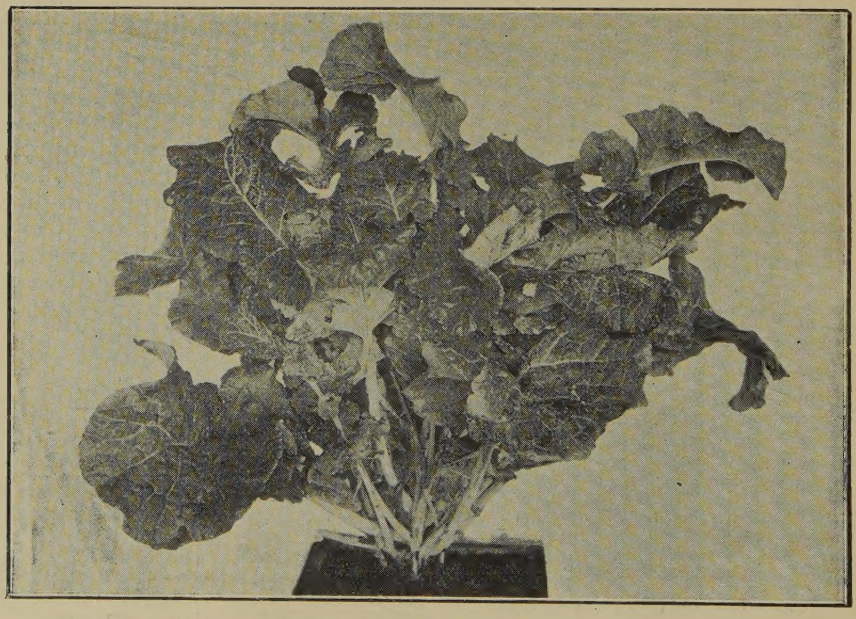

FIG. 5. BUDA KALE.
The leaves are thick and fleshy, and resemble those of a cabbage.

The second type of Buda kale is distinct in every respect, even the seed appearing quite dissimilar. This type is illustrated in Fig. 5. The leaves are thick and fleshy—more in the nature of cabbage-leaves.

While we cannot detect any difference between rape and the rape-like Buda kale, yet the fleshy-leaved type is distinct from any material we have had under trial, and we think this may be regarded with justification as the true Buda kale.

Thousand-headed Kale.

No marked variations could be noted in the samples under trial, and all were characteristically branched. The illustration (Fig. 6) is of a young plant in which no very definite stem formation has yet

FIG. 6. THOUSAND-HEADED KALE.

developed. At a later stage a hard, woody, and unpalatable stem is produced from which arise numerous lateral shoots. It is from this feature that its name arises.

Chou Moellier, or Marrow-stem Kale.

All lines of this variety sent in proved to be pure and true to type. A central stem is developed very early and bears large fleshy leaves. There is little or no lateral branching. The stem is enlarged and consists of a hard outer layer of woody tissue surrounding a soft and palatable core; hence the name marrow-stem kale. (Fig. 7.)

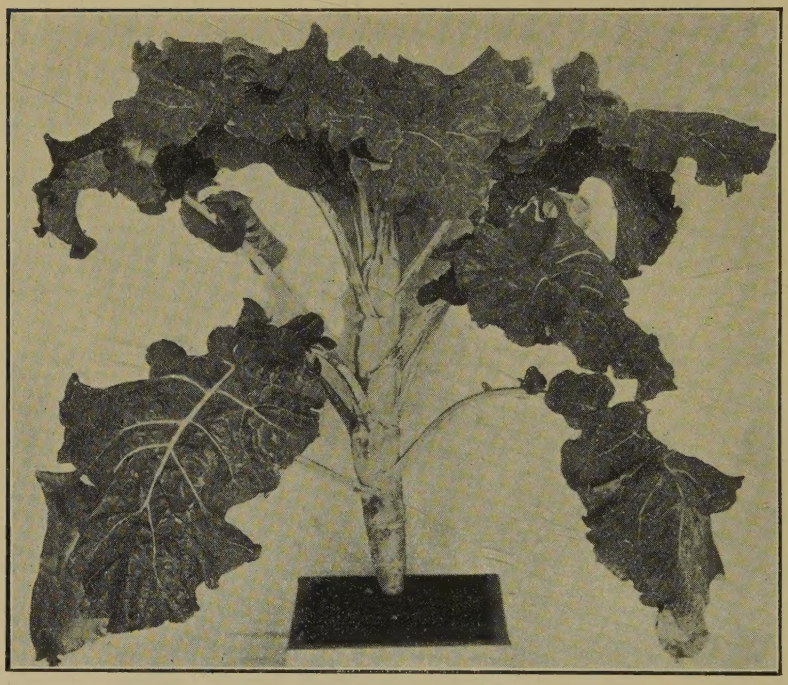

FIG. 7. CHOU MOELLIER, OR MARROW-STEM KALE.

In this, as in thousand-headed kale, there appears to be no misunderstanding as regards nomenclature.

Analyses of Kales.

Seed was sown in the nursery at the end of October last, and a month later the seedlings were transplanted 2 ft. apart each way. Samples for analysis, representing four months' growth, were taken on 26th February.

At this stage the rape-kale and Buda kale were probably at their best, but under normal conditions the chou moellier and thousand-headed kale would have stood for a longer period before being utilized. On the other hand, the rape which has been included for purposes of comparison was perhaps slightly overmature. This point is emphasized because the stage of maturity has probably a direct bearing on chemical analysis and palatability, although it is a matter for conjecture as to just how far or in what direction this factor influences the results obtained.

The analyses of rape given in Table 2 are an average of the three types described in the *Journal* for October, 1931. All samples were collected from the one area and from plants receiving similar treatment. The only factor in doubt and which might upset comparisons has been that of maturity.

Table 2.—Chemical Analyses of Rape and Kales.

Variety.	Sample.	Dry Matter Percentage.	Percentages of Dry Matter.				
			Ether Extract (Crude Fat).	Fibre.	Protein.	Nitrogen-free Extractives.	Ash.
Rape ..	Whole plant..	11·36	4·80	10·52	29·29	43·70	11·69
	Leaf-blade ..	15·35	4·89	11·58	42·90	31·95	8·68
	Mid-rib and stalk of leaf	7·84	2·87	13·08	25·72	44·97	13·36
Rape-kale	Late type ..	10·51	4·70	11·28	32·58	39·94	11·50
	Early (smooth)	10·57	4·97	11·48	25·78	45·01	12·76
	Early (medium wrinkled). (Fig. 3)	9·66	7·0	7·1	32·64	41·84	11·42
Buda kale	Fleshy-leaved type	9·95	5·50	11·74	32·03	37·59	13·14
	Rape type ..	9·73	5·16	10·74	29·90	40·88	13·32
Thousand-headed kale	Leaf, including mid-rib and stalk	10·90	4·51	10·54	23·28	48·12	13·55
	Stem ..	17·39	2·05	28·05	15·24	41·28	13·38
Chou moellier	Leaf, including mid-rib and stalk	9·88	4·05	11·64	20·50	50·03	13·78
	Stem ..	15·98	2·27	20·78	20·40	37·25	19·30

—Analyses by B. W. Doak, Plant Research Station.

Palatability Trials.

Small plots of all the kales sent in for trial were grown at the Marton Experimental Area under the direction of the Fields Superintendent, Palmerston North. They were sown on land adjoining a grass paddock, and by removing the dividing netting sheep were admitted. Records were taken periodically by the overseer of the proportion of each line consumed. The area was dressed with 3 cwt. of superphosphate, and sowing took place on 19th November, 1931.

Table 3.—Palatability Trials with Kales, Season 1931–32.

Variety.	Yield, 12/2/32. (Maximum 10.)	Percentage grazed on Dates indicated.						Recovery, 9/5/32. Max. 10.
		15/2/32.	16/2/32.	18/2/32.	19/2/32.	22/2/32.	23/2/32.	
Thousand-headed kale	7·9	Nil	Nil	10	24	71	100	5·5
Rape-kale, late	3·0	Nil	5	70	82	92	100	2·0
Rape-kale, early	8·5	3·2	60	100	..	..	..	3·5
Fleshy-leaved Buda kale	6·7	65	95	100	..	..	..	2·5
Rape-like Buda kale	7·5	50	82	100	..	..	..	2·0

On 12th February, 1932, an estimate of yield was taken, and on the 13th ten sheep of mixed ages and sexes were put on the plots. On the 15th for the first time, and thereafter periodically, an estimate was made of the proportion grazed on each plot. Results are shown in Table 3; the figures are averages for each variety under trial.

The outstanding feature in this table is the low palatability at this stage of thousand-headed kale and late rape-kale. These were not grazed to any extent until the others were practically eaten out. The low initial yield of the late rape-kale, and its small recovery, together with its unpalatable nature, render it of doubtful value.

It will be appreciated that the recoveries taken on 9th May are not altogether a fair estimate, since the more palatable varieties were grazed much more severely and over a longer period.

ORCHARD SPRAYS IN NEW ZEALAND.

III. THE COPPER SERIES—*continued.*

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2. Burgundy Mixture.

This spray was first used by Masson (1887) in France for the control of downy mildew (*Plasmopara viticola*) of the grape. Masson's experiments were conducted in the province of Burgundy, hence the popular name. The spray is prepared in a similar manner to bordeaux mixture, save that washing-soda (sodium carbonate, Na_2CO_3) is used in place of lime.

The chemistry of burgundy mixture was partially studied by Pickering (1910), who stated that the reactions between copper sulphate and washing-soda led to the production of a basic copper carbonate, and in addition to sodium sulphate and sodium bicarbonate. Pickering found that when the mixture was prepared in the proportions (by weight) of 1 : 1·84 practically all the copper was precipitated. As a result of this investigation he recommended the formula 5–9–50 for the preparation of burgundy mixture.

This spray (in the formula of 4–5–40) has been popular in New Zealand, specially among nurserymen, florists, and small-fruit growers, owing to the ease with which small quantities can be prepared, and to the relative purity, availability, and ease of storage of the washing-soda. The introduction of hydrated lime has made the preparation of bordeaux mixture as simple as that of burgundy; consequently, as the latter is inferior to bordeaux in several respects (being more liable to cause injury when used as a summer spray, especially if mixed with lead arsenate), there is no valid reason why it should any longer occupy a place in the spray programme when hydrated lime is available.

3. Other Copper Sprays.

(a) The Cuprammonium Sprays.—By adding ammonia to copper sulphate solution it is possible to prepare a spray which differs from bordeaux and burgundy in that, instead of a precipitate, a deep blue

solution is formed. Similar sprays may be prepared by using ammonium carbonate in place of ammonia, or by replacing copper sulphate with metallic copper or the so-called copper carbonate of commerce. The advantage claimed for the ammonia spray is that, being in the form of a solution, it does not disfigure fruit or foliage to which it is applied. In practice, however, it has been found that a certain amount of deposit is present on sprayed plants.

(b) Cheshunt Compound.—A soil fungicide which may be used with safety in the vicinity of growing plants has been recommended by Bewley (1922). This preparation (termed "Cheshunt Compound," after its place of origin, the Cheshunt Experimental Station, England) is prepared by mixing 2 parts (by weight) of powdered copper sulphate with 11 parts of freshly powdered ammonium carbonate. Following mixing the preparation is stored for twenty-four hours before using in an airtight glass or stone jar, and in this form may be kept indefinitely. One ounce of this dry mixture is dissolved in ½ pint of hot water, and added to 2 gallons of cold water. The solution should be used as rapidly as possible after preparation. This solution may be applied to the soil in which plants are growing without causing injury, and is thus of value in combating damping-off, fusarium-wilt of tomato, and other related diseases of seed-boxes and the glasshouse.

(c) Copper Acetate. — Copper acetate sprays have been used in France for many years. Butler and Smith (1922) have recently studied their behaviour and preparation, and claim that they are non-toxic to the plant, form less conspicuous spray deposits than the cuprammonium sprays, and compare favourably with bordeaux mixture as fungicides. There are two types of these recommended, the neutral and the basic, depending on whether the neutral or basic acetate of copper is used in its preparation. Their relatively high cost when compared with bordeaux mixture have limited the use of these sprays.

(d) Colloidal Copper Hydroxide.—This preparation, made by precipitating copper hydroxide from a solution of copper sulphate, by treatment with a 10-per-cent. solution of sodium hydroxide, has been stated by Hooker (1923, 1925) to give control equal to bordeaux mixture 3–4–50, when used at a dilution containing one-fifteenth the copper present in the bordeaux. Its application does not appear to have been carried beyond the experimental stage, possibly because of the difficulty of preparing a homogeneous mixture, and the relatively high cost of the final product.

(e) Copper Sulphate Solution.—This has been recommended at different times as a spray for dormant trees. In New Zealand it has been used for this purpose at the rate of from 5 lb. to 10 lb. to 50 gallons of water, and has been applied at the same strengths to potatoes as a controllant of late-blight. The solution has been found to cause severe injury both on dormant trees (especially peaches and nectarines) and on potatoes, even at dilutions in excess of those recommended, and for this reason it is not to be recommended as a spray.

(f) Copper-lime Dusts.—Although these have been used to a certain extent in North America, those tried out in New Zealand have proved worthless as controllants of orchard diseases, and in addition have frequently caused severe injury. The cost of these dusts in the

Dominion is from three to five times as great as that of comparable bordeaux sprays, and as they have proved of little value as fungicides it is obvious that they have no place in the spray programme.

Effects of Copper Sprays upon Fungi and Plants.

(a) Factors affecting Fungicidal Efficiency.—Copper sprays have proved to be the most effective fungicides known, save against the rust fungi and true mildews, and in consequence have had a wide application.

The fungicidal action of bordeaux mixture (and also of most of the other copper fungicides discussed) is dependent upon certain factors, as (1) the proportions of copper sulphate to lime used in preparing the spray; (2) the time of application; (3) the type of organism against which it is being used; (4) the type of plant to which it is being applied; and (5) meteorological conditions during and following application.

The proportions of copper sulphate to lime directly affect the solubility of the spray, and this in turn affects its lasting properties upon the plant. Thus Pickering (1907), and Bedford and Pickering (1910, and 1919, p. 182) have shown that if the proportions are in the region of 6 parts of copper sulphate to 1 part of lime (by weight), 25 per cent. of the total copper is liberated; if the proportions are approximately 4 : 1, then 10 per cent. is liberated; whereas if the proportions are 1 : 1 (as in the "equal" bordeaux chiefly in use to-day) no copper is liberated until several hours after mixing, the amount gradually passing into solution being between 1 and 3 per cent., according to the quantity of excess lime used, and to certain other factors which need not be discussed. These workers concluded that, if judged by the fungicidal efficiency alone, a bordeaux prepared in the 6 : 1 proportions would be about twelve (or possibly eighteen) times as effective as an "equal" bordeaux in which the same amount of copper sulphate was used. But in practice they found that the effectiveness was actually only five times as great.

Experience has shown that a bordeaux with a high soluble copper content is unsafe to use, even on dormant trees, causing injury of a type similar to that produced by copper sulphate alone. It has been found that bordeaux sprays with a high soluble* copper content are relatively inefficient when compared with the "equal" type (that is, sprays in which copper sulphate and lime are used in equal proportions), largely owing to their solubility being such that they remain on the plant for a relatively short time only. As the principal object in applying a bordeaux spray (especially in the earlier parts of the season) is to cover the foliage and fruits with a protective cover, it is evident that the more insoluble the spray the longer it will persist, and therefore the more effective it will prove, within limits. The necessary decrease in available copper and persistence upon the plant are secured by increasing the quantities of lime in relation to the amount of copper sulphate used, for it has been shown that an increase in the proportion of lime in the mixture decreases the solubility of

* "Soluble copper" does not mean that free metallic copper is present in the solution, but that the copper is present in the form of soluble organic or inorganic salts.

the copper up to the point where the proportions of copper sulphate and lime are about the same, as in the "equal" types of bordeaux.

The time of application is significant in that it affects the amount of spray injury which may follow. Consequently different dilutions of spray are used during different periods of the year, for a spray with a relatively high soluble copper content may be applied with a reasonable degree of safety during the dormant or semi-dormant period, yet be quite unsafe to apply during the actively growing period. For this reason it is customary to recommend two formulæ, one for winter the other for summer application. There is a growing tendency, however, to recommend for use at all seasons the formula which may be used with safety during the growing period, for it is becoming recognized that many of the "winter" formulæ contain excessive amounts of copper sulphate, and are not only likely to cause injury but are unnecessarily expensive.

The concentration of the spray, and incidentally its time of application, are determined to a certain extent by the type of disease-producing organism against which a spray is applied. Thus in combating leaf-curl of peaches it is well known that control depends not so much upon the formula used in the preparation of the spray as upon the time of application, which is judged by the period of development of the tree. Summer applications, however numerous, are of little worth in combating this disease. Again, with many diseases which appear only during the growing season, dormant applications are useless. Furthermore, the rust fungi and true mildews cannot be combated by applications of bordeaux mixture or other copper compounds here discussed.

The type of plant limits the application of bordeaux mixture, for some will tolerate this spray throughout the growing period, whereas others suffer severe injury following even dilute applications. Thus, under New Zealand conditions, it is unsafe to apply bordeaux mixture to peaches or apples during the summer months, yet quite safe to use this spray on most varieties of pears, small-fruits, and potatoes. Dilution makes it possible to spray certain of these intolerant plants (as most varieties of apples) provided it is carried to a sufficiently low point; but this introduces the possibility of inefficient control of disease, and should not on this account be attempted unless supported by experiments conducted over several seasons.

Certain meteorological conditions, such as rainfall and atmospheric humidity, may affect both the persistence of the spray and its effects upon the tree. Orchardists are familiar with the fact that bordeaux remains but a brief time on the plant if application is followed by rain, and it appears that plants in localities of high humidity are more intolerant of this spray than those grown in areas with a low humidity.

(b) Effects upon Fungi.—The actual manner in which bordeaux mixture or other copper sprays act as a fungicide is still in dispute. A review of the literature shows that the copper is apparently the active agent, and this may act either in the form of soluble copper salts or as solid particles.

Where soluble copper is considered to be the active agent it is believed that it is liberated from the insoluble copper hydroxide (or basic carbonates of many workers) by (1) solvent action of the fungus, (2) secretions produced by the host plant, (3) by the carbon dioxide of

the atmosphere dissolved in the precipitation moisture covering surfaces of leaves and fruits, or (4) other chemical substances present in minute quantities in the atmosphere.

It has been demonstrated experimentally that soluble copper salts are toxic to spores and hyphæ of many species of fungi, and it is this knowledge which has led to the general belief that soluble copper is the active agent. Cerasoli (1921) demonstrated that grape leaves infected with downy-mildew possessed an acid reaction, and considered that the action of weak acids or acid salts excreted by this fungus during its entry into the tissues brought about solution of copper salts. Bedford and Pickering (1910) found that apple laterals infected with powdery-mildew also possessed the ability to liberate soluble copper, but found that the spores alone were unable to act similarly. They (1919, p. 188) demonstrated that certain plant decoctions, secretions from injured leaves and from apparently uninjured leaves of certain plants, were able to liberate copper salts from bordeaux mixture. Millardet and Gayon (1887) showed that soluble copper was present in rain water dripping from sprayed plants, and concluded that this was liberated by the action of carbon dioxide and traces of ammonium compounds present in rain water.

From these particulars it is evident that copper salts may be liberated when in contact with plants which are infected with certain fungi; but whether this action is due to the fungus or to secretions from injured plant tissues (injuries induced by fungi, insects, or mechanical means) is not clear, owing to the experimental difficulties which must be overcome before definite proof is forthcoming. That atmospheric moisture is in some manner connected with solubility of bordeaux or burgundy mixtures is evidenced by the fact that spray injury is present to a greater extent in regions of high than of low humidity.

A belief that copper sprays act as fungicides because the copper is in the form of solid particles (of copper oxide) has been supported by the Villedieux (1924) and Chaine (1929). But this belief is scarcely justified by the experimental evidence submitted by these workers.

(c) Effects upon the Plant. — (1) Spray injury: This would appear to be governed by the degree of spray tolerance of the plant and the percentage of soluble copper liberated by the particular spray used.

On leaves injury is usually indicated by the appearance of discoloured spots or blotches, the affected portions usually becoming brown and ultimately dying. Injury of this type is rare on pome fruits, potatoes, tomatoes, and small-fruits (unless the quantities of spray used are excessive) but is often severe on peaches, nectarines, apricots, and certain varieties of plums. It is a feature of injury of this type that it is more noticeable towards the latter part of the growing season, and is especially troublesome on leaves which have been injured by insect attack, probably because of the greater liberation of soluble copper. On stone fruits severe cases of summer spray injury are often followed by partial defoliation.

On fruits injury assumes the appearance of russet, and is usually severe only during the earlier stages of development. In the Dominion apples suffer severely in this respect, irrespective of the dilution of

bordeaux used, and in consequence this spray has been replaced by lime-sulphur as a summer fungicide. On peaches and apricots spray injury is usually indicated by fruit drop, but where the fruits persist they often show disfigurement and in extreme cases distortion. Cherries especially are liable to this type of injury. Plums of certain varieties will tolerate summer dilutions of bordeaux mixture without injury.

Naturally, injury depends on the dilutions and proportions of the spray, and to a lesser extent on meteorological conditions. Unfortunately, even at dilutions considerably in excess of those recommended, russet of certain varieties of apples and leaf injury of stone fruits is liable to occur, and for this reason summer applications of bordeaux are confined to most varieties of pears, to potatoes, tomatoes, and small-fruits.

(2) Spray stimulus: It has long been known that copper sprays often appear to induce a healthier foliage, which tends to persist for a longer time than that of unsprayed plants or those sprayed with lime-sulphur. This has been attributed to several factors. Thus by several workers the stimulatory effect has been considered as being due to an increase of chlorophyll content of the leaf, and consequently to an increase of carbon assimilation, either by the effect of minute quantities of copper or of iron present in the copper sulphate as an impurity. But as this healthy foliage is also apparent in plants sprayed with colloidal sulphur, it is evident that this explanation does not account satisfactorily for the apparent benefit.

A second hypothesis is to the effect that the dense coating applied tends to slow down the metabolic processes of the leaf—and, by partial blockage of the stomata, that of transpiration—to such an extent that the life of the leaf is prolonged. This also, is open to criticism, since the stimulatory effect is apparent when leaves are sprayed with copper-ammonium sprays, which, being solutions, do not leave a solid residue.

It is probable that the explanation is much simpler, and that the benefit of spraying is attibutable to protection from the attacks of leaf parasites.

Recommendations for the Use of Copper Sprays.

From the foregoing matter it is evident that finality has not been reached in improving copper sprays, but, pending further experiments, it is inadvisable to make recommendations other than those based on results secured in the past. These results show that, of the copper series, bordeaux mixture is the most efficient spray; consequently recommendations will be confined to the application of this spray under New Zealand conditions.

Growers may use hydrated lime bordeaux in preference to quicklime bordeaux with every confidence, since in our experiments of the past three seasons it has given equally efficient results, and has the added merit of being much easier to prepare. Since 1 lb. of quicklime is equivalent to 1·32 lb. of hydrated lime, some variation in the recommended formulæ might be expected with the replacement of quicklime by hydrated lime. Experience has shown, however, that owing to the finer state of division and greater purity of the hydrated lime the same formula may be used for either hydrated lime or quicklime bordeaux mixture.

The following formulæ are recommended until such time as they may be improved by further experiments: 5–4–50 for dormant or semi-dormant applications, and 3–4–50 for summer use.

To prepare bordeaux mixture, fill the spray tank about three parts full with water; dissolve the required quantity of copper sulphate in water (5 lb. for each 50 gallons of water), add to the tank, and start the agitator running. The copper sulphate may be dissolved with rapidity if hot water is used (5 lb. will go into solution in a minute or so in 1 gallon of boiling water), or, if first powdered, may be added directly to the spray tank according to the method described under instant bordeaux, in which case it will go into solution within two minutes. When the dissolved copper sulphate has been added to the tank, weigh out the required quantity of hydrated lime (4 lb. for each 50 gallons of water), mix to a thin paste with cold water, and with the agitator still running pour slowly into the tank, at the same time filling the tank to its capacity. Keep the agitator running for a further few minutes, and the spray is then ready for application.

As a foundation spray in the control of black-spot of apples, one application only of 5–4–50 bordeaux is recommended to be applied at green-tip, this being preferable to lime-sulphur. For black-spot of pears, two applications of this strength may be used, one at green-tip, a second at pre-pink; and further applications of bordeaux 3–4–50 may be made at intervals through the growing season. Where black-spot is absent but powdery-mildew prevalent, the use of lime-sulphur is advised, since bordeaux mixture will not combat the latter disease.

For control of brown-rot, leaf-curl, and other fungous diseases of stone fruits, one application (or preferably two) of 5–4–50 bordeaux at bud-movement is recommended. As bud-movement is often difficult to define, and varies somewhat with different varieties and in different localities, even in the same orchard, it is preferable to use two close ratio applications at this strength, the first at pre-bud movement, the second at post-bud movement. If varieties are highly susceptible to brown-rot or leaf-rust, and moderately resistant to leaf-curl, it is advisable to use a lime-sulphur spray in addition to bordeaux. For although bordeaux is the most effective controllant of leaf-curl, shot-hole, bladder-plum, die-back, and certain other diseases, it is not as effective as lime-sulphur (or colloidal sulphur) against brown-rot, and is practically worthless against leaf-rust.

For diseases of potatoes and tomatoes bordeaux 5–4–50 should be used if the season is a wet one or where late-blight is prevalent; otherwise use 3–4–50.

For control of citrus-verrucosis of citrus fruits it has been found in the United States that a bordeaux and oil combination gave more satisfactory results than bordeaux alone, the combination being apparently first used by O'Byrne (1922). The procedure recommended (Winston, Bowman, and Yothers, 1923) is to add a 1-per-cent. solution of emulsified oil to the bordeaux. In New Zealand successful results have been secured with a 1-per-cent. solution of a white or summer oil added to a 3–4–50 bordeaux mixture. The combination is prepared by pouring the oil emulsion slowly into a full tank of bordeaux while the agitator is running. The agitator must be kept running until the tank has been emptied, as the oil separates from the bordeaux if the mixture is allowed to stand. This combination will also combat insect pests, such as scale insects, of lemons and oranges.

Cheshunt compound may be used with safety in the form recommended as a controllant of damping-off in seed-boxes, or as a preventive of fusarium-wilt if this appears in tomatoes grown under glass.

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PASTURE ESTABLISHMENT ON RECLAIMED TIDAL FLATS.

SOME EXPERIMENTAL WORK AT WHANGAREI.

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The harbours of North Auckland contain large areas of tidal flats bordering the main waterways and tidal rivers. The total area of such land in Whangarei Harbour which could be reclaimed by stop-banks is estimated at upwards of 6,000 acres, and in several of the other harbours still larger areas could be reclaimed.

These tidal lands vary in character. Three main types are represented: (1) Soils of a silty nature, which crack readily on draining and take grass well; (2) typical mangrove mud soils, stiff and impervious, and showing little tendency to crack; and (3) sandy soils, generally overlying beds of pipi-shells which are often quite close to the surface, showing no cracking even when thoroughly drained. The question of cracking is important in connection with the rapidity with which the salt is washed out of the soil. Of the three types the sand and shell soils occur in large areas in the east coast harbours, while the predominating type on the west coast is mangrove mud.

About seven years ago the Whangarei Harbour Board reclaimed, by constructing stop-banks and a flood-gate, about 100 acres adjacent to the town, mainly comprising sandy shell areas with mangrove mud bordering the water channels. When the water had been shut off for three years arrangements were made for the Department of Agriculture to carry out experimental work in the grassing of this land, an area of 16 acres being made available for the purpose. Open drains connected with the outlet drain were constructed round three sides of the area, which was about 13 chains square. Up to the present experimental work has been confined to an area of 9 acres, consisting practically all of the sand and shell type, covered originally with saliconia, which was still growing, though fleabane was commencing to appear, when the work commenced.

The experimental work was designed to test under-drainage compared with open drains, ploughing compared with surface cultivation, and autumn sowing of grass-seed compared with spring sowing. At the same time six grass-seed mixtures were made up by the Agrostologist, Plant Research Station, for trial purposes. These consisted of (1) a basal mixture of perennial rye 15 lb., Italian rye 5 lb., paspalum 4 lb., white clover (N.Z.) 1 lb., strawberry clover 1 lb., alsike 1 lb., and Lotus major 1 lb. per acre, to which the following were added for separate additional plots: (2) Cocksfoot 10 lb., crested dogstail 3 lb.; (3) browntop 2 lb.; (4) timothy 2 lb., meadow foxtail 4 lb., meadow fescue 6 lb.; (5) subterranean clover 1 lb., suckling clover 2 lb., Lotus hispidus 2 lb.; (6) red clover 3 lb., English trefoil 2 lb.

In December, 1928, 4½ acres were under-drained with manuka fascine drains placed 2 chains apart. Half this area and half the undrained section was ploughed and left fallow until March, and the remainder of the area surface cultivated with disk harrows. Early in April, 1929, the grass-seed was sown with 3 cwt. per acre of basic

superphosphate in plots 13 chains long across the different drainage and cultivation treatments. Half the area was left for spring sowing, but as it was not possible to work horses on the undrained area until late in November this section was left to be sown in the autumn of 1930.

The initial strike was quite satisfactory on the fascine-drained section, but the only species to establish on the undrained portion were perennial rye-grass and a little strawberry clover. Growth on the under-drained area was slow during the winter and early spring, but by the first summer the clovers commenced to come away, particularly the strawberry clover, and at the end of the first year quite a good sward of clovers had been established and the perennial rye began to strengthen up. During the second spring the rye-grass improved rapidly and white clover was more prominent, though still dominated by the strong growth of strawberry. Cocksfoot also showed up in the autumn, and paspalum plants were noticeable.

A still further improvement in the proportion of perennial rye and white clover to strawberry clover occurred in the third year, and at the time of writing an excellent sward of perennial rye, white clover, and strawberry clover is established in the under-drained area, with paspalum, cocksfoot, red clover, and alsike most prominent of the other species sown, several of which, however, have not shown up at all.

On the undrained portion a striking contrast was noticeable all through. With the exception of a strip alongside the last fascine drain, which has gradually extended from ½ chain at the end of the first year to about 1 chain or a little more at the present time, on which quite a good sward has established, the rest of the area lies wet and cold in the winter. It is devoid of grass except for patches of strawberry clover, which are gradually extending and being invaded by perennial rye and white clover.

Whereas the effect of the underground drains was noticeable for a distance of ½ chain in the first year, and rapidly extended to 1 chain or more at the end of the second year, the open drain alongside the plots has not affected the grass for more than ¾ chain out. This illustrates one advantage of closed drains. The initial strike and early growth was slightly better on the ploughed areas than on the surface cultivated ones, the difference being mainly in the better establishment and growth of perennial rye. The outstanding feature of the trial is the very striking effect of under-drainage on this type of land, which shows no tendency at all to crack or open up when dewatered and drained.

The plots included a small area of the mangrove mud type overlying a bed of shells at a greater depth than those on the sandy area. Here the only species to establish were brown-top, paspalum, and lotus species, none of which have grown well. After ploughing, most of the surface soil was carried away by a flood. This type tends to bake hard in the summer-time and is comparatively impervious to water in the winter, and is coming in much more slowly than the more typical sandy shell area adjoining. Rushes are also bad on the former area.

There is no doubt that here also under-drainage is an important factor in the more rapid establishment of grasses and clovers, among which paspalum and Lotus major may be expected to play a prominent part in establishing a sward, particularly if allowed to seed.

WHEAT-MANURING EXPERIMENTS IN THE SOUTH ISLAND, SEASON 1931–32.

Fields Division, Department of Agriculture.

In the 1931–32 season twenty-seven experiments on the manuring of wheat were laid down in Canterbury and North Otago, and one experiment was conducted in Southland at the Gore Experimental Area. In Canterbury and North Otago the season was abnormally dry through the spring and summer, and in certain localities crops were very poor and difficult to harvest. On this account four of the experiments had to be abandoned. The general method of conducting this class of experiments was described in the *Journal* for July, 1926.

Types of Experiment, 1931–32.—Three main types of experiment were carried out. Type A and, with certain modifications, Types B and C were a continuation of the previous season's programme. The treatments per acre for each type of experiment are shown below. Super and super plus lime were drilled in with the seed in all cases.

Type A—

(1) No manure.	
(2) Superphosphate (44/46)	1 cwt.
(3) Super	2 cwt.
(4) Super 1 cwt., plus nitrate of soda 1 cwt.	2 cwt.
(5) Super 2 cwt., plus nitrate of soda 1 cwt.	3 cwt.
(6) Super 1 cwt., plus carbonate of lime 2 cwt.	3 cwt.

Ten experiments of this type were carried out, two of which were abandoned. The nitrate of soda was top-dressed in the spring, during the latter part of September in most cases.

Type B—

(1) No manure.	
(2) Super	1 cwt.
(3) Super 1 cwt., plus nitrate of soda 1 cwt.	2 cwt.
(4) Super 1 cwt., plus nitrate of soda 1½ cwt.	2½ cwt.
(5) Super 1 cwt., plus sulphate of ammonia 1 cwt.	2 cwt.
(6) Super 1 cwt., plus sulphate of ammonia 1½ cwt.	2½ cwt.

Ten experiments of this type were carried out. The nitrate of soda was top-dressed during the latter part of September and the sulphate of ammonia about a month earlier. Nitrate of soda and sulphate of ammonia are compared on an equal weight of manure per-acre basis.

Type C—

	Time of Application of Nitrogen.
(1) Super.	
(2) Super 1 cwt., plus sulphate of ammonia 1 cwt.	With seed.*
(3) Super 1 cwt., plus nitrate of soda 149 lb.	Late August.
(4) Super 1 cwt., plus sulphate of ammonia 1 cwt.	Late August.
(5) Super 1 cwt., plus nitrate of soda 149 lb.	Late September.
(6) Super 1 cwt., plus sulphate of ammonia 1 cwt.	Late September.
(7) Super 1 cwt., plus nitrate of soda 149 lb.	Late October.

* Following on good results from applying sulphate of ammonia at time of seeding at the Waite Institute, South Australia, this treatment was included at the suggestion of Mr. W. V. Blewett, of Imperial Chemical Industries (Australia-New Zealand), Ltd.

Each nitrogen-treated plot received the same amount of *nitrogen* per acre (sulphate of ammonia = 20·6 per cent. N, nitrate of soda = 15·5 per cent. N). Four of this type of experiment were sown, but two had to be abandoned.

In addition to the above, an experiment conducted on the farm of F. W. Carpenter, Prebbleton, was on the same lines as the Type C experiments, except that calcium cyanamide was included. Certain plots having a basal dressing of super 1 cwt. received calcium cyanamide 1 cwt. per acre in late August; others received this amount of calcium cyanamide in September. Similar trials conducted on the same farm in previous years have been the subject of articles in the *Journal* (March, 1931, and July, 1931). Other trials of similar type were also discussed in the latter publication.

Miscellaneous Types.—One experiment using spring-sown wheat was laid down on the lines of Type A experiments referred to above, except that sulphate of ammonia was used instead of nitrate of soda and was applied with the seed. Sulphate of ammonia 1 cwt. per acre was also included with Treatment 6 (super 1 cwt., plus carbonate of lime 2 cwt.).

An experiment was carried out at the Gore Experimental Area (Southland) using the following treatments per acre: (1) No manure; (2) super 2 cwt.; (3) super 2 cwt., plus sulphate of potash 1 cwt.; (4) super 2 cwt., plus nitrate of soda 1 cwt.; (5) super 2 cwt., plus sulphate of potash 1 cwt., plus nitrate of soda 1 cwt. The nitrate of soda in Treatments 4 and 5 was top-dressed on 22nd October.

Size of Plot and Number of Replications.—As in the previous year each plot was 2 chains in length and 7 coulter rows wide. Twelve replications of each treatment were sown in each experiment, except Carpenter's, in which twenty-four replications were sown. In order to reduce the liability of "fertility slope" influencing yields, the treatments were arranged in opposite order on each side of a middle plot.

Interpretation of Results.—Results were examined statistically, although modern statistical thought demands randomization of treatments within each series, and this was not provided for reasons which need not be discussed here. Differences between treatments may be accepted with confidence when stated to be "significant." Where differences are "not significant" they may be real, but they cannot be accepted with any degree of confidence.

Estimation of Profits or Losses from Manures applied.—General averages are used for estimation of monetary returns in tables. The following prices are used for computing these returns, and in the case of manures are the approximate ex-store prices: Wheat 3s. 6d. per bushel (per bushel cost such as threshing, bags, hauling, railage, &c., are taken as about 1s., and this amount is deducted from the average price for Tuscan wheat delivered in store); superphosphate 4s. 6d. per cwt.; nitrate of soda 14s. 6d. per cwt.; sulphate of ammonia 10s. per cwt.

The amount of wheat required to meet the cost of 1 cwt. of each of the fertilizers used is approximately as follows: $1\frac{1}{3}$ bushels for 1 cwt. of super; 4 bushels for 1 cwt. of nitrate of soda; 3 bushels for 1 cwt. of sulphate of ammonia.

Particulars of Trials and Yields from Treatments.

Particulars of the individual trials and yields from the various treatments are set out in Tables 1 to 9 which follow.

Table 1.—Locations of Trials, Previous History of Field, Variety of Wheat, Rate of Seeding, Date of Sowing of Crop, Date of Nitrogen Application, and Date of Harvesting.

Serial No.	Name.	Address.	Previous History of Field.	Variety of Wheat.	Rate of Seeding per Acre.	Date sown.	Date Nitrogen applied.	Date harvested.
			Type A Experiments.		lb.			
1	High School ..	Rangiora, Canterbury ..	1930–31, barley; 1929–30, potatoes; 1928–29, grass	Solid-straw Tuscan	95	2/6/31	24/9/31	29/1/32
2	D. Mulholland ..	Darfield, Canterbury ..	1930–31, rape; 1928–30, grass	Solid-straw Tuscan	100	4/6/31	25/9/31	20/1/32
3	R. T. McMillan ..	Irwell, Canterbury	1926–31, grass	Solid-straw Tuscan	100	29/5/31	5/10/31	19/1/32
4	J. Finlay	Eiffleton, Canterbury ..	1930 31, rape; 1929–30, wheat; 1928–29, peas	Solid-straw Tuscan	90	9/6/31	18/9/31	2/2/32
5	J. O'Grady	Winchmore, Canterbury ..	1930 31, rape; 1929 30, wheat; 1928–29, grass	Solid-straw Tuscan	90	4/6/31	19/9/31	3/2/32
6	L. Fenwick	St.Andrews, South Canterbury	1923–31, grass	Hunter's ..	120	2/6/31	21/9/31	4/2/32
7	J. D. Grant	Awamoa, North Otago ..	1930–31, rape; 1929–30, Western Wolths; 1928–29, oats	Hunter's ..	110	22/5/31	25/9/31	1/2/32
8	R. Dick	Weston, North Otago ..	1920–31, grass	Hunter's ..	90	19/5/31	24/9/31	4/3/32
			Type B Experiments.					
9	H. E. Evans.. ..	Fernside, Canterbury ..	1930 31, rape; 1927–30, grass	Solid-straw Tuscan	100	20/5/31	19/8/31* 29/9/31	11/1/32
10	C. Rands	Springbank, Canterbury ..	1930 31, wheat; 1929–30, turnips; 1928 29, grass	Solid-straw Tuscan	114	18/5/31	19/8/31 29/9/31	7/1/32
11	M. Wilson	Halkett, Canterbury ..	1930–31, wheat; 1929–30, turnips; 1928–29, rape	Solid-straw Tuscan	100	25/5/31	19/8/31 24/9/31	12/1/32
12	T. Pearson	Hororata, Canterbury ..	1926–31, grass	Solid-straw Tuscan	100	11/5/31	19/8/31 25/9/31	22/1/32
13	A. Amos	Wakanui, Canterbury ..	1930–31, lupins (harvested); 1929–30, wheat; 1928–29, peas	Solid-straw Tuscan	110	15/5/31	28/8/31 18/9/31	20/1/32
14	J. Ruddenklau ..	Methven, Canterbury ..	1930–31, wheat; 1926–30, grass	Solid-straw Tuscan	90	2/6/31	28/8/31 23/9/31	1/2/32
15	W. McCully	Geraldine, South Canterbury	1930–31, rape; 1929–30, fallow; 1926–29, grass	Solid-straw Tuscan	105	12/5/31	20/8/31 18/9/31	12/1/32

Table 1—continued.

Serial No.	Name.	Address.	Previous History of Field.	Variety of Wheat.	Rate of Seeding per Acre.	Date sown.	Date Nitrogen applied.	Date harvested.
					lb.			
			Type B Experiments—continued.					
16	A. Barnett	Morven, South Canterbury ..	1930–31, rape; 1928–30, grass	Hunter's ..	80	25/5/31	20/8/31* 24/9/31	26/1/32
17	Waitaki Boys' High School	Oamaru, North Otago ..	1924–31, grass	Hunters ..	120	26/6/31	3/9/31 24/9/31	11/2/32
18	D. M. Borrie ..	Papakaio, North Otago ..	1930–31, wheat; 1929–30, western wolths ..	Hunter's ..	102	20/5/31	7/9/31 24/9/31	2/2/32
			Type C Experiments.					
19	F. W. Carpenter ..	Prebbleton, Canterbury ..	1930–31, wheat; 1929–30, potatoes; 1928–29, grass	Solid-straw Tuscan	104	22/5/31	(3, 4, 5)† 27/8/31 (6, 7, 8) 23/9/31 (9)28/10/31	15/1/32
20	G. H. Cross ..	Oxford, Canterbury ..	1930–31, rape; 1928–30, grass	Solid-straw Tuscan	97	19/6/31	(3 and 4) 21/8/31 (6 and 7) 28/9/31 (9)23/10/31	29/1/32
21	D. Spence	Sherwood, Canterbury ..	1930–31, wheat; 1927–30, grass	Solid-straw Tuscan	90	17/7/31	(3 and 4) 20/8/31 (6 and 7) 23/9/31 (9)21/10/31	30/1/32
			Miscellaneous Trials.					
22	W. Donald	Amberley, Canterbury ..	1930–31, turnips; 1927–30, grass	Solid-straw Tuscan	120	8/9/31	With seed ..	23/1/32
23	Gore Experimental Area	Gore, Southland	1930–31, swedes; 1929–30, oats; 1928–29, turnips	Garnet ..	181	3/10/31	22/10/31	3/3/32

* The first date indicates the date of application of sulphate of ammonia, the second the date nitrate of soda was applied.
† Figures in brackets represent the treatment numbers (see Table 4) to which manures were applied.

Table 2.—Yields in Bushels per Acre from Different Treatments in Type A Experiments.

Serial No.*	No Manure.	Super 1 cwt.	Super 2 cwt.	Super 1 cwt. + Nitrate of Soda 1 cwt.	Super 2 cwt. + Nitrate of Soda 1 cwt.	Super 1 cwt. + Lime 2 cwt.
1 ..	44·9	51·8	53·4	54·2	53·9	53·3
2 ..	16·5	18·6	17·1	16·9	16·8	19·4
3 ..	43·3	45·9	44·2	49·8	50·0	45·2
4 ..	31·2	36·0	35·2	35·4	35·0	35·2
5 ..	12·0	17·4	18·0	16·2	17·0	17·7
6 ..	26·5	30·5	29·3	30·0	29·8	30·4
7 ..	37·9	41·1	40·3	41·9	42·9	43·0
8 ..	27·3	34·6	32·0	33·7	34·3	35·8
23 ..	19·6	†	22·4	..	23·5	..

*See Table 1 for location of trials. †Super 1 cwt. not used. The yields of super 2 cwt. plus sulphate of potash 1 cwt. was 23·0 bushels, and that of super 2 cwt. plus sulphate of potash 1 cwt. plus nitrate of soda 1 cwt. was 23·5 bushels. Owing to bird damage the results of this experiment cannot be regarded as highly reliable. Observations during growth indicated a considerable superiority of super over no manure. Plots to which potash was added appeared to be superior to those having super only, though the figures do not show any marked superiority.

Table 3.—Yields in Bushels per Acre from Different Treatments in Type B Experiments.

Serial No.*	No Manure.	Super 1 cwt.	Super 1 cwt. + Nitrate of Soda 1 cwt.	Super 1 cwt. + Nitrate of Soda 1½ cwt.	Super 1 cwt. + Sulphate of Ammonia 1 cwt.	Super 1 cwt. + Sulphate of Ammonia 1½ cwt.
9 ..	17·9	22·2	19·5	19·1	20·0	21·1
10 ..	22·4	25·2	26·7	26·3	25·6	28·1
11 ..	24·6	28·3	30·4	30·6	28·7	31·4
12 ..	29·4	35·9	36·0	38·0	41·8	39·8
13 ..	42·8	49·1	50·6	50·9	49·9	49·8
14 ..	34·3	42·5	40·3	38·5	42·9	42·9
15 ..	27·8	33·2	33·9	35·7	33·1	35·7
16 ..	30·4	37·0	38·5	40·6	38·7	40·2
17 ..	33·7	46·5	48·0	45·5	45·5	46·6
18 ..	19·0	22·3	21·9	23·4	23·9	23·9
22† ..	5·9	9·0	..	..	8·1	..

*See Table 1 for location of trials. †Spring-sown wheat. Yields of other treatments in this trial are as follows: Super 2 cwt., 10 bushels per acre; super 2 cwt. plus sulphate of ammonia 1 cwt., 9 bushels; super 1 cwt. plus lime 2 cwt. plus sulphate of ammonia 1 cwt., 9·3 bushels.

Table 4.—Yields in Bushels per Acre from Different Treatments in Type C Experiments.

Treatments per Acre.*	Month of Nitrogen Application.	Yields in Bushels per Acre of Experiments, Serial Nos.		
		19.	20.	21.
(1) Super 1 cwt.	..	45·9	28·5	20·1
(2) Super 1 cwt., plus sulphate of ammonia 1 cwt.	With seed ..	52·1	28·9	23·8
(3) Super 1 cwt., plus sulphate of ammonia 1 cwt.	August ..	50·2	28·0	22·9
(4) Super 1 cwt., plus nitrate of soda 149 lb.	August ..	52·3	30·4	23·6
(5) Super 1 cwt., plus calcium cyanamide 1 cwt.	August ..	46·6	..	..

Table 4—continued.

Treatments per Acre.*	Month of Nitrogen Application.	Yields in Bushels per Acre of Experiments, Serial Nos.		
		19.	20.	21.
(6) Super 1 cwt., plus sulphate of ammonia 1 cwt.	September ..	49·8	29·0	22·0
(7) Super 1 cwt., plus nitrate of soda 149 lb.	September ..	51·1	30·3	24·3
(8) Super 1 cwt., plus calcium cyanamide 1 cwt.	September ..	48·1	..	..
(9) Super 1 cwt., plus nitrate of soda 149 lb.	October ..	50·2	32·4	23·8

* See Table 1 for location of trials.

Analysis of Effects of Manures.

The increases due to treatments are shown in Tables 5 to 8, supplemented by detailed comments.

Table 5.—Differences in Yields in Bushels per Acre between (a) Super 1 cwt. and No Manure; (b) Super 1 cwt. plus Nitrate of Soda 1 cwt. and Super 1 cwt. (Type A, B, and C Experiments).

Serial No.	Increase due to Manures.		Serial No.	Increase due to Manures.	
	Increase of Super 1 cwt. over No Manure.	Increase of Super 1 cwt. + Nitrate of Soda over Super 1 cwt.		Increase of Super 1 cwt. over No Manure.	Increase of Super 1 cwt. + Nitrate of Soda over Super 1 cwt.
1 ..	**6·9**	2·4	12 ..	**6·5**	0·1
2 ..	**2·1**	**—1·7**	13 ..	**6·3**	1·5
3 ..	**2·6**	**3·9**	14 ..	**8·2**	**—2·2**
4 ..	**4·8**	—0·6	15 ..	**5·4**	0·7
5 ..	**5·4**	—1·2	16 ..	**6·6**	1·5
6 ..	**4·0**	—0·5	17 ..	**12·8**	1·5
7 ..	**3·2**	0·8	18 ..	**3·3**	—0·4
8 ..	**7·3**	—0·9	19 ..	..	**5·2***
9 ..	**4·3**	—2·7	20 ..	..	1·8*
10 ..	**2·8**	1·5	21 ..	..	**4·2***
11 ..	**3·7**	**2·1**	22 ..	**3·1**	..
	Average increases			5·2	0·8

* In these experiments the September application of nitrate of soda only has been considered for inclusion in the above table, and the amount of nitrate of soda used was 149 lb. per acre.

Note.—Figures in heavy type in this and subsequent tables, where such occur, represent statistically significant differences.

Comments on Table 5.

Super 1 cwt.—The average increase due to super 1 cwt. (nineteen experiments) equals 5·2 bushels per acre. The average profit due to super 1 cwt. equals 13s. 8d. per acre. In all experiments super has increased the yield to a significant extent. Up to the season under review the average increase from the use of 1 cwt. super in ninety-one experiments conducted over eight seasons was 4·1 bushels per acre, so that the increase due to super 1 cwt. in the 1931–32 season was above the general average, which latter, including the 1931–32 season, is 4·3 bushels per acre.

Nitrate of Soda.—From the average of twenty-one experiments the increase due to nitrate of soda 1 cwt. (those marked by an asterisk received 149 lb.) was 0·8 bushels per acre. Obviously the dry conditions experienced in the 1931–32 season were unfavourable to response from the use of nitrogen. In the previous season, when pre-harvest weather was also very dry, the average increase for 1 cwt. of nitrate of soda was 2·6 bushels per acre, and even this represented the lowest seasonal average for some years. Nitrate of soda has given significant increases in only four out of twenty-one experiments, and on the basis of 4 bushels of wheat being required to pay for 1 cwt. of nitrate of soda only one experiment shows a paying return. The average loss due to the use of nitrate of soda amounts to 11s. 6d. per acre.

Table 6.—Differences in Yields in Bushels per Acre between (a) Super 2 cwt. and Super 1 cwt.; (b) Super 2 cwt. plus Nitrate of Soda 1 cwt. and Super 1 cwt. plus Nitrate of Soda 1 cwt.; (c) Super 1 cwt. plus Lime 2 cwt. and Super 1 cwt. (Type A Experiments).

Serial No.	Super 2 cwt.: Increase or Decrease in relation to Super 1 cwt.	Super 2 cwt. + Nitrate of Soda 1 cwt.: Increase or Decrease in relation to Super 1 cwt. + Nitrate of Soda 1 cwt.	Super 1 cwt. + Lime 2 cwt.: Increase or Decrease in relation to Super 1 cwt.
1 ..	**1·6**	−0·3	1·5
2 ..	**−1·5**	−0·1	**0·8**
3 ..	−1·7	0·2	−0·7
4 ..	−0·8	−0·4	−0·8
5 ..	0·6	0·8	0·3
6 ..	**−1·1**	−0·2	−0·1
7 ..	**−0·8**	**1·0**	**1·9**
8 ..	**−2·6**	0·6	1·2
Average ..	−0·8	0·2	0·5

Comments on Table 6.

Comparisons between Super 2 cwt. and Super 1 cwt.—The average *decrease* in yield of super 2 cwt. when compared with super 1 cwt. is 0·8 bushels per acre. In only one experiment was super 2 cwt. significantly better than super 1 cwt., but in four experiments significant depressions in yield were recorded. These results confirm findings of previous seasons that in general there does not appear to be any advantage in increasing the quantity of super above 1 cwt. per acre.

Comparisons between Super 2 cwt. plus Nitrate of Soda 1 cwt. and Super 1 cwt. plus Nitrate of Soda 1 cwt.—The average increase of super 2 cwt. plus nitrate of soda 1 cwt. over super 1 cwt. plus nitrate of soda 1 cwt. equals 0·2 bushels per acre. Even when used with nitrogen, on the average the use of the greater quantity of super does not appear to be justified.

Comparison between Super 1 cwt. plus Lime 2 cwt. and Super 1 cwt.—The average increase of super 1 cwt. plus lime 2 cwt. over super 1 cwt. equals 0·5 bushels per acre. In Experiments 2 and 7 the addition of lime has caused significant increases. Experiments 1 and 8 also show fair increases due to lime, though not to a significant extent. During the three seasons in which the addition of lime to superphosphate has

been tried on wheat, nine out of a total of thirty-seven experiments have shown increases of 1½ bushels or more from the use of 2 cwt. of carbonate of lime, the largest increase being 2½ bushels. Generally speaking, these increases have occurred on soils highly deficient in lime, although other soils equally deficient have not given responses. The use of lime as an addition to super sown with wheat cannot be recommended generally, although in some places its use will result in a small profit.

Table 7.—Differences in Yields between (a) Nitrate of Soda 1 cwt. and Sulphate of Ammonia 1 cwt.; (b) Nitrate of Soda 1 cwt. and Nitrate of Soda 1½ cwt.; (c) Nitrate of Soda 1½ cwt. and Sulphate of Ammonia 1½ cwt. (Type B Experiments).

(All treatments received 1 cwt. of super in addition to nitrogenous fertilizers.)

Serial No.	Nitrate of Soda 1 cwt.: Increase or Decrease in relation to Sulphate of Ammonia 1 cwt.	Nitrate of Soda 1½ cwt.: Increase or Decrease in relation to Nitrate of Soda 1 cwt.	Nitrate of Soda 1½ cwt.: Increase or Decrease in relation to Sulphate of Ammonia 1½ cwt.
9 ..	−0·5	−0·4	**−2·0**
10 ..	+0·9	−0·4	**−1·8**
11 ..	**+1·7**	+0·2	−0·8
12 ..	**−5·8**	+2·0	−1·8
13 ..	+0·7	+0·3	+1·1
14 ..	**−2·6**	**−1·8**	**−4·4**
15 ..	+0·8	**+1·8**	0·0
16 ..	−0·2	**+2·1**	+0·4
17 ..	−2·5	−2·5	−1·5
18 ..	**−2·0**	**+1·5**	−0·5
Average ..	−0·95	0·3	−1·1

Comments on Table 7.

Comparisons between Nitrate of Soda 1 cwt. and Sulphate of Ammonia 1 cwt.—In one experiment (No. 11) nitrate of soda 1 cwt. is significantly better than sulphate of ammonia 1 cwt., and in three experiments (Nos. 12, 14, and 18) sulphate of ammonia 1 cwt. is the better. The average difference in favour of sulphate of ammonia 1 cwt. is 0·95 bushels per acre. In fourteen trials in which sulphate of ammonia 1 cwt. was used the average increase of sulphate of ammonia 1 cwt. plus super over super alone was 1·0 bushels per acre. In five of these trials the increases due to sulphate of ammonia were significant, but in only three of these were the increases payable. The average loss due to the use of sulphate of ammonia 1 cwt. amounts to 6s. 6d. per acre.

NOTE.—It must be remembered that sulphate of ammonia contains 20·6 per cent. nitrogen and nitrate of soda 15·5 per cent., so that the sulphate of ammonia supplies practically one-third more nitrogen than nitrate of soda.

Comparisons between Nitrate of Soda 1 cwt. and Nitrate of Soda 1½ cwt.—The use of the higher quantity of nitrate of soda has resulted in an average increase of 0·3 bushels per acre.

Comparisons between Nitrate of Soda 1½ cwt. and Sulphate of Ammonia 1½ cwt.—When these two are compared the average difference in favour of sulphate of ammonia 1½ cwt. is 1·1 bushels per acre. In

three experiments this superiority is significant, whereas no significant differences are shown in favour of the nitrate of soda.

Table 8.—Increases in Bushels per Acre over Super alone of Super plus Nitrogenous Fertilizers applied at Different Times, in Bushels per Acre.

Fertilizer and Quantity per Acre.	Month of Application.	Increases in Bushels per Acre in Experiments, Serial Nos.		
		19.	20.	21.
Sulphate of ammonia 1 cwt.	With seed* ..	6·2	0·4	3·7
	August ..	4·3	−0·5	2·8
	September ..	3·9	0·5	1·9
Nitrate of soda 149 lb. ..	August ..	6·4	1·9	3·5
	September ..	5·2	1·8	4·2
	October ..	4·3	3·9	3·7
Calcium cyanamide 1 cwt. ..	August ..	0·7	..	..
	September ..	2·2	..	..
Standard error		0·701	0·695	0·260

* For dates of sowing seed, see Table 1.

Any differences in yield greater than three times the standard error are statistically significant.

Comments on Table 8.

General Effect of Nitrogenous Manures.—In Experiment serial No. 19 all nitrogenous dressings, with the exception of calcium cyanamide (August), gave significant increases over super alone. In Experiment 20 only one treatment (nitrate of soda applied in October) has given a significant increase, while in Experiment 21 all nitrogenous dressings gave significant increases. Calcium cyanamide, which caused foliage of crop to yellow after application, has been the least effective; taken on the whole, nitrate of soda has been slightly more effective than sulphate of ammonia. It should be remembered, however, that equivalent quantities of nitrogen were applied, so that 149 lb. nitrate of soda was applied in these experiments, whereas in the Type B experiments equivalent quantities of sulphate of ammonia and nitrate of soda were applied, with results on the average in favour of the sulphate of ammonia.

TIME OF APPLICATION OF SULPHATE OF AMMONIA AND NITRATE OF SODA.

(1) Sulphate of Ammonia.—In two experiments the early applications of sulphate of ammonia with the seed gave the largest increases in yield. In Experiment 21 sulphate of ammonia with the seed was significantly better than the August or September applications, and in Experiment 19 the application with the seed was significantly better than the September dressing and almost significantly better than the August dressing. In Experiment 20 no significant differences were recorded, nor was there any definite trend as in the other two trials.

(2) Nitrate of Soda.—Except in the case of Experiment 19, there are no significant differences between the yields from nitrate of soda

applied at different times; in fact, the greatest increases due to it resulted from applications in different months in the three experiments.

(3) Comparison of Results in Season 1931–32 with those of Seasons 1929–30 and 1930–31.—In order that comparisons may be made between results of the Type C trials summarized above and similar trials conducted previously, the increases given over the control (super only) plots by sulphate of ammonia and nitrate of soda applied at different times in trials carried out during the 1929–30 and 1930–31 seasons are given in Table 9. The average increases for the whole of the seven trials carried out to date are also given.

Table 9.—Summary of Increases over Control (Super 1 cwt.) Plots of Sulphate of Ammonia and Nitrate of Soda applied at Different Times from Experiments 1929–30 and 1930–31, and Average Increases from All Type C Experiments conducted to Date (1931–32).

Treatment per Acre.	Time of Application.	Increases in Bushels per Acre in Type C Experiments as indicated.				Average Increases‡ over Control in Seven Trials to Date.
		F. W. Carpenter, Prebbleton, 1929–30.*	F. W. Carpenter, Prebbleton, 1930–31.†	C. M. Talbot, Tycho, 1930–31.†	J. R. McCulloch, Ngapara, 1930–31.†	
Sulphate of ammonia 1 cwt.	August ..	9·3	3·4	2·8	2·0	3·4
	September	7·4	3·6	3·5	2·7	3·3
	October..	5·5	1·7	2·6	2·5	(4 trials only)
Nitrate of soda 149 lb.	August ..	8·5	6·2	1·8	3·6	4·5
	September	10·8	6·2	5·0	3·5	5·2
	October	10·7	4·0	5·4	5·0	5·3

* *Journal*, March, 1931, page 185. † *Journal*, July, 1931, page 46. ‡ Including results from Table 8.

From the general average this table indicates that the earlier applications of sulphate of ammonia and later applications of nitrate of soda have been the most successful. Although there is not a great difference between August and September dressings of sulphate of ammonia, the marked success of the latter applied with the seed during the 1931–32 season and the inferiority of October dressings in the 1929–30 and 1930–31 seasons suggest that sulphate of ammonia may give the best results when applied at seeding-time. It must be kept in mind, however, that the one season in which the application with the seed has been tried was abnormally dry in the spring and summer.

Summary and General Conclusions.

The results of twenty-three experiments on the manuring of wheat in the South Island conducted in the 1931–32 season are given. The effects on yield of superphosphate, super plus lime, nitrate of soda, and sulphate of ammonia are analysed, and the relative effects of applying nitrate of soda, sulphate of ammonia, and calcium cyanamide at different time are discussed. The outstanding features are as follows :—

The average increase (5·2 bushels per acre) resulting from the use of superphosphate 1 cwt. was above the nine-year average (4·3 bushels per acre), while the average increases from nitrate of soda or sulphate

of ammonia were the lowest recorded in the last four seasons, during which time experiments have been fairly widely distributed.

In every experiment 1 cwt. superphosphate gave significant and payable results. Super at 2 cwt. per acre, however, gave, on the average, returns slightly below those of super 1 cwt. While the use of 1 cwt. super is strongly recommended, the evidence to date tends to discourage the recommendation of a greater quantity.

The use of lime as an addition to super cannot be advocated generally, although small profits resulted on some soils highly deficient in lime.

The good average results secured from nitrogen in the seasons 1927–28 and 1928–29 have not been repeated in the past two seasons. Both the latter were characterized by extremely dry pre-harvest conditions, and were so abnormal in this respect as to justify the conclusion that the climatic conditions were chiefly responsible for the poor effects from the use of nitrogen. The average effect over a large number of seasons can be determined only by continuing the present series of investigations. September and October have been in the main the best months for applying nitrate of soda, while August applications of sulphate of ammonia have proved better on the average than dressings applied later. The application of sulphate of ammonia with the seed gives promise of being the most successful, but until further trials have been conducted nothing definite can be stated.

The Department extends its thanks to those farmers who provided land for carrying out the experiments.

The field-work in connection with the experiments was carried out under the direction of Mr. R. McGillivray, Fields Superintendent, Christchurch, by Instructors G. G. Calder, Christchurch, E. M. Bates, Ashburton, W. Stafford, Timaru; and under the direction of Mr. R. B. Tennent, Fields Superintendent, Dunedin, by Instructor T. A. Sellwood, Oamaru, and W. Sleeman, Overseer, Gore Experimental Area.

—A. W. Hudson, Crop Experimentalist, Plant Research Station.
—J. W. Woodcock, Assistant Crop Experimentalist.

SUPERPHOSPHATE IN THE DRINKING-WATER FOR CATTLE.

A NUMBER of inquiries have been received with reference to the proportions of superphosphate and water to be used in giving cattle phosphate in a water-soluble form for supplementing a deficiency of phosphate, and perhaps also of calcium, in the food-supply in cases where it is impracticable to use enough super for top-dressing, or even when none at all can be used.

The proportions which have been found practicable to give in this way are 1 lb. of superphosphate in 100 gallons of soft drinking-water. Cattle will drink this readily enough when no other source of supply is available, but when puddles abound in the paddock no guarantee can be given that they will not forsake the medicated water for a time.

It should be noted that soft water is specified, as hard water which contains lime would tend to throw out of solution the valuable soluble phosphate.

—B. C. Aston, Chief Chemist, Department of Agriculture.

EFFICIENT NESTING CONDITIONS FOR FOWLS.

A NEW TYPE OF NEST RACK.

L. C. COCKER, Poultry Instructor, Live-stock Division, Wellington.

THERE are certain essentials required in nesting arrangements for fowls which the nondescript makeshift type of nest commonly provided on the average poultry plant does not conform to. Under such conditions the nests rapidly become breeding-grounds for red mite and other parasitic vermin, resulting in increased costs and a depleted egg-yield.

In view of the requirements of nesting facilities, it is difficult to entirely dispense with wood for construction purposes, hence the necessity for avoiding as far as possible joints or crevices wherein parasitic pests may take up their quarters. The materials used for nesting should be capable of being easily dismantled in order to facilitate cleaning and disinfection, otherwise sooner or later infestation of quarters is almost sure to result.

In an endeavour to meet the problem poultry-keepers have used empty petrol-tins cut down as nests. Changing methods in the distribution of petrol supplies, however, have largely eliminated this source of supply and raised the question of substitutes for the purpose. The tins, while useful, being practically vermin-proof, possess certain disadvantages in that they are rather small, and, having hard bottoms, have never filled the requirements of the ideal nest. Apparently the fowls dislike the hard tin bottoms, as evidenced by their restlessness in settling down. In an endeavour to overcome this natural dislike to artificial conditions, sawdust or sand have been used for nesting materials with more or less success.

Associated with the use of petrol-tin nests is the unavoidable occurrence of several hens endeavouring to use the nest at the same time. In the ensuing struggle for possession any eggs that may be present in the nest are liable to become broken, and this is often the forerunner to an outbreak of the objectionable habit of egg-eating. Soft-shelled and broken eggs in the nests are always a source of trouble, even if only in the fouling of nest and material, and the resulting washing required before the remaining eggs are in a fit condition to market.

The writer is of the opinion that in commercial practice, where the natural instinct displayed by the hen on range in seeking solitude for nesting can only be complied with to a small extent, it is a much sounder policy to make the nests large enough to readily accommodate two or perhaps three birds at the same time. The limited space, coupled with the inclination of hens kept under artificial conditions to seek joint occupation of nests, has at times been responsible for the vice of vent picking, which if unchecked often leads to a worse trouble —cannibalism—becoming established.

Unable to secure sufficient comfortable nesting space, the interloper will eventually lay her egg in full view of other birds, which may be on the running-boards fronting the nests. While so doing there is

the temptation for other birds to pick at the fleshy vent, often with fatal consequences. If such troubles are to be prevented, the factor of seclusion is of paramount importance in the arrangement of the nests.

With the continued improvement of our strains of fowls from an egg-laying viewpoint, and the constant endeavour to increase the size of eggs, slight hæmorrhages due to minor ovary and oviduct troubles are apt to make their appearance, and these, if not provided against as before stated, may result in unnecessary loss of stock.

The Nest Rack described.

An effort has been made to solve or control in part the difficulties that have been mentioned by means of the nest rack, designed by the writer, shown in the accompanying illustrations.

Briefly stated, the requirements of the ideal nest are as follows: (1) Seclusion from the members of the flock, other than for laying purposes; (2) sanitary construction, allowing of easy dismantling for cleaning and disinfecting; (3) capacity for being closed up when not required for nesting purposes; (4) possession of a bottom which will mitigate against the possibility of cracked eggs due to contact with a hard substance; (5) ease of manipulation for the gathering of eggs by the attendant. These several factors are provided for, and the nest rack offers a cheap, practical, and efficient way of meeting the essentials referred to. The rack has been constructed largely of wood for the sake of convenience, but is capable of being made from angle iron for supports and framing, with sheet iron for doors and partitions of nests.

The natural instinct of the hen to seek seclusion in her nest is encouraged and met by providing entrances to the nests from a running-board at the back of the rack, and facing either the side or front walls of the house. Further seclusion is secured by keeping the floor of the nests 5 in. below the level of the running-board, which, in effect, keeps the occupant well below the range of interference. The running-board is hinged to the rack by reversing the position of the hinges—that is, by screwing them on upside down. The hinges then act as locks and supports for the running-board. If further support is deemed advisable, a right-angle support screwed on to the board will serve the purpose.

When not required to admit the birds to the nests, the boards may be raised to a perpendicular position, thus presenting a barrier to entrance. Facilities for this purpose provide a much-needed practical aid during the moulting season, when many sparsely feathered birds seek the extra shelter of the nests, with spoiling effect on the nest material and eggs alike.

In introducing the principle of joint occupation of nests, the writer has chosen the lesser difficulty in view of the hen's natural tendencies when housed in flocks under semi-intensive conditions. As a general rule, the last occupant will quietly gather any eggs present under herself, leaving ample room, and obviating any cause for fighting to secure possession of the nest.

There appears to exist in fowls a natural aversion to hard conditions under foot, for whenever given the opportunity under free range conditions they will invariably seek a soft secluded spot in which to

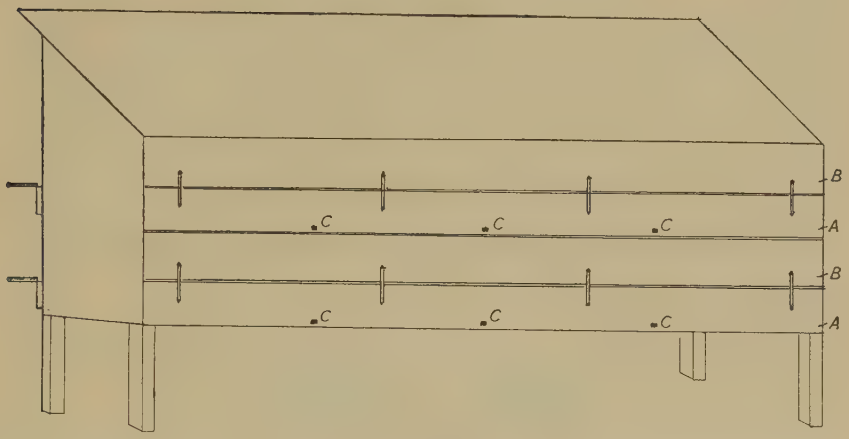

FIG. I. THE NEST RACK, SHOWING DOORS FOR GATHERING EGGS CLOSED, RUNNING BOARDS IN POSITION, AND NESTS OPEN.

make their nest. This tendency has been provided for by using ½-in.-mesh wire-netting for nest-bottoms, with straw as nesting material. In effect, this should largely remove the necessity for so many eggs requiring to be cleaned before being in a fit condition to market. No doubt hard nest-bottoms are largely responsible for many cracked and stained eggs. In addition, the use of netting will ensure that if by chance an egg becomes broken or fouling of the nest take place there is at least some possibility of the offending matter finding its way through the netting and out of the nest.

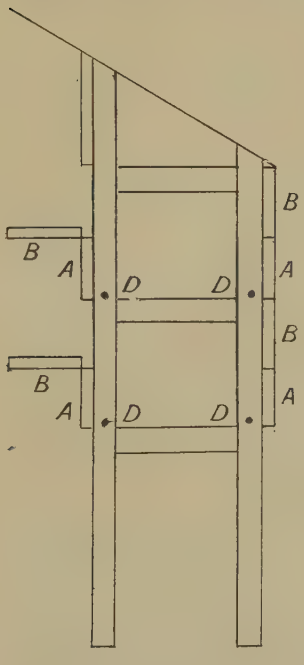

FIG. 2. CROSS-SECTION OF FIG. I.

The wire-netting forming the floor is threaded on to iron bolts, punctuated at three 20-in. spaces with eye-holes through which the cross bolts also threaded pass, and are secured on the inside and outside of the racks by nuts. See points marked "C" in Fig. 1, and "C" and "D" in Fig. 4. The ends are secured by staples to the end braces.

It will be necessary when constructing the rack to assemble the floor, and place it in position before screwing on boards "A" and "B," otherwise difficulty will be experienced in assembling the rack. Conduit or small calibre water-piping will serve for longitudinal bolts, with heavy fencing wire for cross bolts, if a cheaper method of construction is desired.

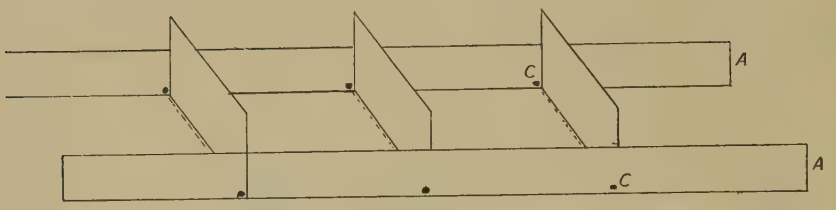

FIG. 3. SHOWING METHOD OF ASSEMBLING THE NEST PARTITIONS (CROSS BOLTS ONLY).

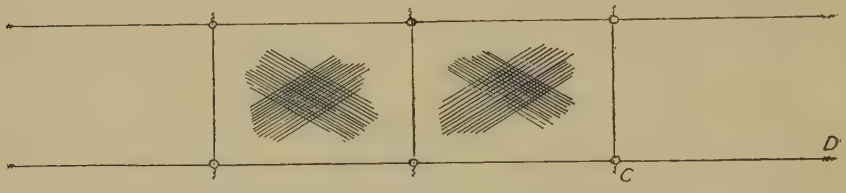

FIG. 4. SHOWING LONGITUDINAL AND CROSS BOLTS, AND WIRE-NETTING FLOOR CONSTRUCTION.

Fig. 3 shows the method of assembling the nests and the partitions of heavy sheet iron or asbestos slate. A rabbeted $\frac{1}{4}$-in. groove is cut at 20-in. spaces on the inner side of boards marked " A," in Figs. 1, 2, and 3, in which the partitions sit. The partitions should be sufficiently high to prevent birds gaining access to nests other than the one entered. Neglect of this essential detail may result in quarrelling and subsequent damage to eggs. Obstructions over which it is possible for a hen to scramble without using her wings as a natural propelling or lifting force are also responsible for some of the ovarian accidents and troubles experienced on poultry plants. In this connection, the top tier of nests in the rack will need a ceiling of wire-netting on a level with the top of the partitions, to counter the increased depth under the sloping roof.

Eggs are gathered from the doors marked " B " in Fig. 1, which are similar in all respects, including method of hinging, to those appearing as running-boards on the opposite side of the rack as shown in Fig. 2. The construction is the same, the only difference being that one board serves as an entrance to the nests when in a horizontal position. When closed, both sides of the rack are similar. Boards " A " and " B " are screwed to the frame to facilitate dismantling.

The construction of the rack does not preclude its use for the purpose of trap-nesting. It is still possible to use the system of traps illustrated in the Department's Bulletin 66, " Utility-poultry Keeping," by closing the usual running-boards, and making the entrance to the nests from the opposite side of the racks. The boards previously doing duty as egg-gathering doors would then become running-boards for entrance to the nests. Extra provision would be needed to carry the additional weight of the traps and the extra running-board required.

The roof and sides of the rack are best constructed of asbestos slate, to facilitate cleaning and sanitary requirements. If desired, a further

tier of nests may be included in the rack without impairing its usefulness; in fact, it can be made to suit any special requirement.

Material used in the construction of the rack is as follows: 2 in. by 2 in. for legs and braces; four boards 6 ft. 8 in. long by 5 in. by 1 in.; four boards 6 ft. 8 in. long by 6 in. by 1 in.; four iron rods or bolts with eye-holes at 20 in. spaces, 6 ft. 9 in. long by $\frac{3}{8}$ in.; six iron bolts $16\frac{3}{4}$ in. long by $\frac{1}{4}$ in. All bolts to be threaded at both ends, with two nuts at each end.

This nesting rack is being installed at the Wallaceville Poultry Station.

SOME ECONOMIC PHASES OF APPLE PRODUCTION IN NEW ZEALAND.

(Concluded.)

D. A. VIGGERS, Farm Economics Section, Department of Agriculture.

REPLACEMENTS.

REPLACEMENT is a phase of orchard management which merits very close attention, for by having to choose from a multiplicity of varieties an orchardist may be in grave doubts as to when he has made a wise choice. Varieties planted present practically a static condition, for once the trees are established they are certain to remain for a number of years. It is because of this static character that the orchardist should be very careful in selection, as, once planted, he can only improve management by extending his knowledge concerning those specific varieties or subsequently reworking the trees if proved a failure.

Selection is a very complex problem. On the one hand there are the characteristics of climate to be considered, and on the other hand the demands of the consumer, while in between are the difficulties of management and intricacies of marketing. In so far as this survey is concerned, it is possible to touch only the fringe of this subject; but mention will be made of some possibilities in this direction, together with what slight details the study affords.

Varietal Characteristics.—Climate controls selection of varieties to a fairly extensive degree, and though wide elasticity exists in choice for a district as a whole a wise choice narrows the field still more, while the numbers available for an individual grower are lessened again. Table 11 shows the proportions of the nineteen leading varieties in the different districts. In reading this table one must be careful, if possible, to distinguish between the popularity for a variety among the growers in a district and the predominance due to survival of the fittest.

A study of the table indicates that as one passes from north to south Sturmer and Jonathan increase in predominance until the South Island is reached, when the proportions do not vary much. Dougherty, on the other hand, shows a preference in the more Northern districts, as also does Gravenstein. Rome Beauty and varieties of lower proportions show a distinct tendency for popularity in the South.

Table 11.—Percentages of Different Varieties (all Ages) in each District.

Variety.	North Auckland.	Waitemata.	Thames.	Waikato.	Gisborne.	Hawke's Bay.	Wairarapa.	Manawatu.	Nelson.	Mapua–Tasman.	Motueka.	Marlborough.	Christchurch.	Southern Coastal.	Tuapeka.	Vincent.	Total.
Sturmer	0·6	0·8	5·3	12·2	18·7	28·0	38·5	29·5	38·3	26·4	36·3	29·1	30·0	24·8	20·7	22·1	24·3
Delicious	41·5	37·4	16·6	26·4	24·5	18·2	8·2	25·3	14·6	17·7	22·6	21·6	14·0	19·9	13·1	22·2	20·4
Jonathan	1·0	5·2	3·3	9·8	8·3	8·7	28·9	6·3	18·2	19·6	9·7	19·7	14·6	8·2	18·2	18·2	14·3
Cox's Orange Pippin	1·2	4·3	3·5	2·6	11·3	7·3	5·5	3·9	6·1	11·6	4·5	7·7	10·0	6·2	9·0	6·5	7·8
Dunn's	2·0	7·0	5·0	2·9	5·5	2·1	11·2	1·6	5·6	8·3	9·5	5·0	3·5	0·8	4·0	2·4	5·8
Dougherty	32·0	2·2	4·6	1·4	3·1	9·2	..	..	1·4	0·9	2·3	0·6	..	..	..	0·2	3·2
Granny Smith	6·4	7·9	10·5	8·4	3·9	3·9	2·0	0·6	1·4	1·7	4·3	..	0·2	..	0·5	0·5	2·7
Statesman	4·8	1·3	..	4·0	3·0	1·8	0·0	1·9	2·7	4·8	1·3	0·4	1·1	4·1	3·1	1·3	2·7
Gravenstein	2·0	9·1	0·7	15·7	1·1	4·0	..	1·3	0·4	2·1	0·1	0·2	0·0	0·3	0·3	0·1	2·4
Ballarat	1·8	6·1	9·3	2·9	15·1	5·7	1·1	2·2	..	0·2	0·1	2·2	2·3	12·6	0·7	0·3	2·2
Rome Beauty	0·1	1·3	2·8	..	..	2·2	0·9	1·5	0·5	0·9	..	1·3	1·3	0·7	3·9	2·6	1·4
Lord Wolseley	..	0·0	..	0·4	..	1·0	0·0	1·6	1·7	0·0	0·0	0·1	9·7	11·1	1·9	0·4	1·4
Cleopatra	..	0·1	1·3	..	..	0·7	1·1	..	0·5	0·1	0·2	..	..	0·5	6·9	8·6	1·2
Washington	..	..	..	0·5	..	0·7	..	18·0	0·7	0·6	3·2	..	..	0·1	..	..	0·7
Worcester Pearmain	..	..	..	..	..	0·1	0·3	0·4	0·2	1·4	0·9	1·4	2·1	2·1	0·2	..	0·7
London Pippin	..	0·4	2·0	0·6	..	0·0	..	..	0·9	0·8	1·9	2·9	0·4	0·2	0·1	2·3	0·7
Tasma	..	0·0	..	..	..	..	..	..	1·3	0·3	1·2	1·5	1·5	0·2	1·5	1·0	0·6
Scarlet Nonpareil	..	..	0·7	..	..	..	..	..	..	..	0·0	..	1·4	0·4	4·0	1·9	0·6
Newtown Pippin	..	..	..	..	..	0·0	..	..	..	0·2	0·2	..	0·7	..	3·9	0·1	0·5
Other varieties	6·6	16·9	34·4	12·2	5·5	6·4	2·3	5·9	5·5	2·4	1·7	6·3	7·2	7·8	8·0	9·3	6·4
Total	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0

If reference is now made to Table 14, the average yields for the mature groups (fourteen years old and over) will confirm this incidence of popularity. Owing to the different levels of production for different districts, it is necessary to remove district effect by choosing a variety that is common to all districts and comparing varieties within districts to that variety. Delicious is suggested as a basis for such a comparison, as the proportions in each district do not vary widely; moreover, it is a very popular variety, averaging 20·4 per cent. of the New Zealand total.

Wise choice necessitates a consideration of soil, a suitable distribution of maturity dates to distribute picking and work dependent on picking, and the inter-relationship of varieties for pollination purposes. Factors such as irregularity of bearing and rate of maturity should be considered, but as yet little is known concerning them. Owing to the large number of trees in Mapua-Tasman in the mature group it has been possible to calculate measures of the variability in yield of seven prominent varieties. Six varieties have all been compared to the seventh—Sturmer—and, so that the results would be strictly comparable, only those orchards appear in Sturmer which also appear for the others. For example, of the sixteen orchards used for Worcester Pearmain the same sixteen were used for the corresponding Sturmers. The results are shown in Table 12.

Table 12.—Average Yield, Deviation of Yield from Average, and Co-efficient of Variability for some Orchards in Mapua-Tasman.

Variety.	Number of Orchards.	Variety under Observation.			Sturmer.		
		Average Yield.	Standard Deviation.	Co-efficient of Variability.	Average Yield.	Standard Deviation.	Co-efficient of Variability.
				Per Cent.			Per Cent.
Dunn's ..	51	1·74±0·10	1·07±0·07	61·4±5·4	2·15±0·09	0·94±0·06	43·6±3·4
Cox's Orange Pippin	52	1·35±0·08	0·82±0·05	60·4±5·3	2·12±0·09	0·91±0·06	43·1±3·3
Delicious ..	50	1·81±0·10	1·01±0·07	56·0±4·8	2·18±0·09	0·96±0·06	44·1±3·5
Statesman ..	24	2·75±0·17	1·25±0·12	45·3±5·2	2·29±0·11	0·83±0·08	36·5±4·0
Worcester Pearmain	16	1·64±0·12	0·71±0·08	43·0±6·0	2·16±0·14	0·80±0·10	37·3±5·4
Jonathan ..	62	1·99±0·10	1·05±0·06	52·7±4·0	2·13±0·08	0·98±0·06	46·1±3·3

Note.—The figures following the ± (plus-minus) sign indicate the range within which the chances are equal for those results to fall within or without the above results if this study were undertaken again under the same conditions.

The term "standard deviation" indicates the variation of a yield around the average, but as one cannot compare these deviations because the averages vary, the co-efficient of variability is used which is the standard deviation expressed as a percentage of the average yield. As the co-efficients of variability for Sturmers vary, it is necessary to eliminate this effect; this has been obtained by expressing the co-efficient of variability of the variety under observation as a percentage of the corresponding co-efficient for Sturmers. The result is seen in Table 13.

Table 13.—Variability of Six Varieties compared with Variability in Sturmers.

Variety.	Index of Variability.
Sturmer	100
Jonathan	114
Worcester Pearmain ..	115
Statesman	124
Delicious	127
Cox's Orange Pippin ..	140
Dunn's	141

Variability is a matter of degree; the foregoing table indicates that Cox's Orange Pippin and Dunn's vary more than 40 per cent. and 41 per cent. respectively than do Sturmers. To the orchardist this is a point of great importance, for, while over a large collection of samples an average tends to a constant amount, in the individual case variation is wide. Thus in comparing yields of single trees or small groups it is clearly not right to compare the on-year of one tree or variety with that of the off-year of another; it is an average over several years, allowing for maturity, that should be considered.

The causes of this variability are difficult to determine. That some may be adduced to differences between orchards is seen in Table 12, where the variability amounts to about 7 per cent. between the Sturmers corresponding to Worcester Pearmain and Statesman and the Sturmers corresponding to the remainder. Irregular bearing and biennial bearing, too, are factors exerting an influence, a fact revealed in Cox's Orange and Dunn's. Another factor is that of pollination. Because of the high efficiency of pollination of some and the low efficiency of others, the tree organization of an orchard, in so far as relationship between different varieties is concerned, undoubtedly has an influence worthy of deep consideration. But because a variety may show great variability that is not sufficient reason to discard it, as other factors may more than compensate for this. While there is an undoubted advantage in having varieties which bear consistently, it should be borne in mind that over a series of years, or even every second year, an average yield will be struck. It is the average yield that matters most.

Table 14 serves to indicate the level of maximum production—that is, the quantity of fruit a tree produces when at the height of its productive powers. It seems reasonable to believe that the level of maximum production is a direct indication of the total quantity of fruit a variety can produce. Therefore this table should be of great value, with existing knowledge, in determining what varieties to choose.

Marketing Factors.—The transport and storage qualities of the fruit must be considered; though for most varieties with the advance in technique of cool storage this factor may be reduced to a point where it can be neglected for practical purposes.

Table 14.—Average Production in Mature Groups (Fourteen Years Old and Over) used as an Indication of the Level of Maximum Production for the more Important Varieties in different Districts.

Variety.	North Auckland.			Waitemata.			Hawke's Bay.			Nelson.			Mapua-Tasman.		
	Yield.	Orchards.	Trees.	Yield.	Orchards.	Trees.	Yield.	Orchards.	Trees.	Yield.	Orchards.	Trees.	Yield.	Orchards.	Trees.
Sturmer	..	..	..	1·52	6	196	4·46	35	7,588	2·22	14	5,287	2·20	70	35,261
Delicious	1·73	3	1,402	2·58	19	3,998	4·63	25	4,380	1·56	14	3,441	1·78	52	16,621
Jonathan	..	..	..	2·05	11	1,308	3·13	46	5,288	2·02	18	5,576	2·01	69	26,777
Cox's Orange Pippin	..	..	..	1·96	6	210	3·13	13	837	1·41	4	343	1·30	53	15,486
Dunn's	..	..	..	3·57	19	2,060	4·39	34	1,359	1·30	11	1,424	1·85	56	12,681
Dougherty	1·94	9	6,111	1·27	9	634	4·54	45	4,511	..	..	..	1·82	13	798
Granny Smith	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Statesman	..	..	..	..	..	..	..	..	..	2·51	5	517	2·98	22	3,899
Gravenstein	..	..	..	2·39	22	2,327	5·67	18	1,110	..	..	..	1·95	11	1,438
Ballarat	..	..	..	3·32	6	541	6·67	16	805	..	..	..	..	..	..
Rome Beauty	..	..	..	2·84	5	160	6·32	21	783	..	..	..	2·19	7	1,259
Lord Wolseley	..	..	..	..	..	..	5·64	14	689	..	..	..	..	..	..
Cleopatra	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Washington	..	..	..	..	..	..	..	..	..	..	..	..	2·69	5	439
Worcester Pearmain	..	..	..	..	..	..	..	..	..	..	..	..	1·63	18	2,195
London Pippin	..	..	..	..	..	..	..	..	..	..	..	..	1·97	10	1,428
Tasma	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Scarlet Nonpareil	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Newtown Pippin	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

(Continued on next page.)

Table 14—continued.

Variety.	Motueka.			Marlborough.			Christchurch.			Southern Coastal.			Tuapeka.			Vincent.		
	Yield.	Orchards	Trees.	Yield.	Orchards	Trees.	Yield.	Orchards	Trees.	Yield.	Orchards	Trees.	Yield.	Orchards	Trees.	Yield.	Orchards	Trees.
Sturmer	2·34	26	10,708	1·80	10	3,544	2·01	23	5,870	1·96	6	1,088	1·58	11	5,598	0·53	15	4,064
Delicious	2·16	16	3,487	1·55	8	2,103	1·58	12	1,871	1·82	4	814	2·26	8	3,232	1·19	10	1,685
Jonathan	2·54	20	4,715	1·29	10	4,011	2·31	26	4,628	..	..	..	1·98	14	7,652	0·59	14	2,204
Cox's Orange Pippin ..	1·96	13	1,844	..	..	..	0·84	17	2,593	..	..	..	0·72	9	1,549	..	..	..
Dunn's	2·36	22	4,635	2·60	5	703	2·53	5	538	..	..	..	1·72	10	2,243	1·41	6	411
Dougherty	2·51	1	695	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Granny Smith	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Statesman	2·92	4	688	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gravenstein	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Ballarat	..	..	..	..	..	..	2·17	6	464	1·41	2	1,042	..	..	..	..	..	..
Rome Beauty	..	..	..	..	..	..	1·89	8	449	..	..	..	3·05	5	1,631	..	..	..
Lord Wolseley	..	..	..	..	..	..	1·89	14	2,491	1·48	3	1,148	..	..	..	..	..	..
Cleopatra	..	..	..	..	..	..	..	..	..	..	..	..	2·10	11	2,222	0·78	8	996
Washington	3·81	4	937	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Worcester Pearmain ..	1·84	6	363	..	..	..	4·91	9	696	..	..	..	..	..	..	..	..	..
London Pippin	2·61	5	419	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Tasma	..	..	..	..	..	..	1·68	4	509	..	..	..	..	..	..	..	..	..
Scarlet Nonpareil	..	..	..	..	..	..	1·11	4	712	..	..	..	1·93	5	1,509	..	..	..
Newtown Pippin	..	..	..	..	..	..	..	..	..	..	..	..	1·80	5	1,552	..	..	..

The intricacies of the price-levels, too, should be considered, though they are one of the most fickle factors of all to determine. In Table 15 an attempt has been made to show the relative values of different varieties over a period of five years on the London market. These averages make no allowance for time of arrival, and are weighted by quotations, but unweighted by years.

Table 15.—Average of Quotations of Fifteen Different Varieties on London Market over Five Years.

Variety.	Quotation in Shillings.	Variety.	Quotation in Shillings.
Cox's Orange Pippin ..	18·49	Rome Beauty	13·60
Granny Smith	18·12*	Sturmer	13·24
Tasma	14·65	Jonathan	13·16
Cleopatra	14·39	Delicious	13·14
Statesman	14·37	Dunn's	12·67
Dougherty	14·24	Lord Wolsely	12·32
Ballarat	14·13*	London Pippin ..	11·96
Worcester Pearmain ..	13·79*		

* Only four years' quotations available.

This table is based on weekly quotations, and, though it serves to indicate the relative importance now, the position may be greatly altered in a few years' time; an increase in supply, a change in consumers' demands, or an alteration in the proportions of varietal quantities required for definite purposes, are factors which may be responsible for a change in relative values. Further, the relative value of varieties on other markets differ as their particular requirements vary.

How varieties conform to consumers' requirements is a question of great moment. In the long-run, if competition is keen, the consumer by discrimination between prices and varieties will force the grower to plant those types favourable to the consumers' requirements. This necessitates a study of factors which operate on the consumer, consciously or unconsciously, in determining what apples he purchases. Studies in consumers' demands in Michigan (H. P. Gaston) indicate that quality and appearance are of prime importance in that order. A buyer will purchase first on appearance, distinct and definite preference being shown for bright-red fruit, and if appearance is indicative of quality, sales continue, but if quality is poor consumers seek their fruit elsewhere; thus, while appearance guides the first choice, the quality of that first choice determines where the second will be. But one must remember that different consumers, and hence different markets, have different requirements. Research not only into the requirements of the consumers on all markets, but also into what those consumers do not want, is important for the progressive orchardist in connection with his replacement programme.

Activity in Replacement.—Table 16 gives an indication of the present activity in replacement. This table defines the present trend in the popularity of varieties, while Table 11 shows the trend as it appears over a long period of years modified by other influences. Sturmer and Delicious hold sway now and will continue to do so for some years, despite the high proportion of Cox's Orange Pippin and Granny Smith

being planted, as the proportion of these in the New Zealand aggregate, compared with Sturmer and Delicious, is small.

Table 16.—Plantings by Varieties and Districts of Trees under Five Years Old.

Variety.	North Auckland.	Waitemata.	Thames.	Waikato.	Gisborne.	Hawke's Bay.	Wairarapa.	Manawatu.
Sturmer	..	134	..	672	50	3,859	428	170
Delicious	525	2,213	50	530	228	1,695	184	99
Jonathan	..	480	..	87	30	708	100	..
Cox's Orange Pippin ..	164	2,185	71	163	145	4,399	100	21
Dunn's	5	727	..	157	..	257	..	..
Dougherty	45	145	40	..	25	69	..	..
Granny Smith ..	1,103	5,162	360	718	114	3,632	352	16
Statesman	..	782	..	346	50	978	5	..
Gravenstein	..	229	4	295	..	889	..	12
Ballarat	82	1,252	155	144	15	1,543	..	20
Rome Beauty ..	..	340	30	..	..	454	..	..
Lord Wolseley ..	..	..	..	30	..	5	10	12
Cleopatra	..	..	..	..	..	4	..	..
Washington	..	..	..	40	..	112	..	32
Worcester Pearmain ..	..	..	..	..	..	..	..	..
London Pippin ..	..	1	..	..	..	..	..	..
Tasma	..	..	..	..	..	..	..	..
Scarlet Nonpareil ..	..	..	..	..	..	..	..	..
Newtown Pippin ..	..	..	..	..	..	..	..	..
Other varieties ..	18	817	355	250	..	2,388	270	24
Total ..	1,942	14,467	1,065	3,432	657	20,992	1,449	406

Variety.	Nelson.	Mapua–Tasman.	Motueka.	Marlborough.	Christchurch.	Southern Coastal.	Tuapeka.	Vincent.
Sturmer	1,155	256	1,287	60	378	200	675	20
Delicious	367	216	200	80	239	245	760	607
Jonathan	5	501	..	..	55	6	..	..
Cox's Orange Pippin ..	917	2,175	148	171	632	597	1,201	444
Dunn's	..	396	..	51	..	..	..	20
Dougherty	..	100	112	100	..	..	..	..
Granny Smith ..	538	2,543	2,126	..	83	..	379	171
Statesman	660	1,942	80	..	155	30	424	..
Gravenstein	135	1,262	60	..	20	..	..	..
Ballarat	..	..	..	98	103	400	..	..
Rome Beauty ..	..	..	..	..	2	..	..	..
Lord Wolseley ..	..	..	..	..	349	106	42	20
Cleopatra	..	..	50	..	..	..	904	..
Washington	..	..	5	..	..	..	..	..
Worcester Pearmain ..	..	..	..	..	..	..	..	..
London Pippin ..	..	..	..	..	93	..	..	..
Tasma	75	123	..	76	160	..	330	102
Scarlet Nonpareil ..	..	..	4	..	..	..	..	..
Newtown Pippin ..	..	..	..	..	..	..	..	..
Other varieties ..	3	200	6	192	258	64	370	..
Total ..	3,855	9,714	4,078	828	2,527	1,648	420	69
							5,505	1,453

A consideration of Table 17 indicates that no definite attempt is being made to concentrate on fewer varieties.

Table 17.—Comparison of Proportions of Varieties for all Trees, and for Plantings under Five Years Old.

Variety.	All Trees.	Plantings under Five Years.	Variety.	All Trees.	Plantings under Five Years.
Sturmer	24·3	12·6	Lord Wolseley ..	1·4	0·8
Delicious ..	20·4	11·1	Cleopatra ..	1·2	1·3
Jonathan	14·3	2·7	Washington ..	0·7	0·2
Cox's Orange Pippin	7·8	18·3	Worcester Pearmain	0·7	0·1
Dunn's	5·8	2·2	London Pippin ..	0·7	..
Dougherty ..	3·2	1·4	Tasma	0·6	1·2
Granny Smith ..	2·7	22·9	Scarlet Nonpareil ..	0·6	..
Statesman ..	2·7	7·4	Newtown Pippin ..	0·5	0·5
Gravenstein ..	2·4	3·9	Other varieties ..	6·4	7·2
Ballarat	2·2	5·1			
Rome Beauty ..	1·4	1·1	Total ..	100·0	100·0

For the other varieties the proportions of plantings under five years do not vary greatly from those for all trees.

There are three broad factors governing selection of varieties for replacement. They are price, yield, and past popularity. Taking the percentage of Cox's Orange Pippin and Granny Smith of total planting within the last five years, and comparing them with the others to the quotations in Table 15, it is clear that price is having an influence on choice. On the other hand, consideration of the yields of Ballarat and Statesman, as shown in Table 14, indicates how selection is biased by heavy yields, while Sturmer and Delicious demonstrate the effect in varietal planting resulting from past popularity.

A wise selection involves a combination of price and yield, for it is upon the total returns that a choice should rest, after allowing for the advantages and disadvantages introduced by subsidiary factors and market fluctuations.

Conclusion.

This study serves to show that much information can be secured from an extensive survey covering only a few of the salient points. The ready response to the schedules submitted is very satisfactory, and if a similar response is forthcoming for the season of 1931–32 the results presented here can be supplemented and confirmed. By building up a service of this nature a great deal of information can be supplied which, if applied, should result in a measureable improvement not only in the industry as a whole, but also in the annual accounts of individual growers. Co-operation in a work of this nature is essential, as it enables results to be attained that no other method can achieve.

The co-operation of all those who submitted information relative to the production of the season under review is gratefully acknowledged, whether such information was suitable for inclusion in analysis or not.

HOT-WATER TREATMENT OF SEED BARLEY.

CROP RESULTS IN CANTERBURY, SEASONS 1930, 1931, 1932.

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SINCE the last report on this work,* conducted by the Canterbury Seed Company, with the advice and assistance of Mr. J. C. Neill, Field Mycologist, Department of Agriculture, further results have come to hand which should be of advantage to barley-growers.

For the past five or six years farmers have derived considerable benefit from the use of smut-free pure strains of barley, and the majority of growers took advantage of the opportunities offered. During the past year, however, a number of farmers reverted to the old method of using their own seed. It is a significant fact that one-third of such crops showed distinct traces of covered smut, and the following Tables 1 and 2 show to what a serious extent the quality of such product was thereby adversely affected. The tables refer to the Canterbury barley crop of 1932, and afford a comparison between the quality of the product of treated seed and of growers' own seed.

Table 1.—Grading of Product of Treated Seed.

(In all the tables mill firsts only are dealt with.)

Quality.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
No. 1 Grade ..	53·39	56·97	88·39	64·67	57·76
No. 2 Grade ..	34·54	27·76	11·61	24·66	28·81
Under grade ..	12·07	15·27	..	10·67	13·43
Total	100·0	100·0	100·0	100·0	100·0
Number of farms ..	44	83	5	9	141
Acres	580	1,221	49	183	2,033

Table 2.—Grading of Product of Grower's own Seed.

Quality.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
No. 1 Grade ..	39·7	18·16	34·80	..	23·41
No. 2 Grade ..	30·0	47·89	57·82	..	45·09
Under grade ..	30·3	33·95	7·38	..	31·50
Total	100·0	100·0	100·0	..	100·0
Number of farms ..	6	34	5	..	45
Acres	107	427	40	..	574

NOTE.—Fourteen out of the above forty-five crops of owner's seed showed traces of covered smut.

* See *Journal* for February, 1930, page 104.

The period of the last three years which is reviewed in the following tables is comprised of one good and two bad seasons. The object of these figures is to provide the barley-grower with information which, used in accordance with the knowledge and judgment of his own particular conditions, may be of assistance to him in selecting which variety to sow. The tables present a condensed summary of the actual harvest results.

ELLESMERE DISTRICT.

Table 3.—Yields per Acre.

Year.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1930 ..	159	3,088	49·04	52·83	25·40	41·15	51·96
1931 ..	221	4,489	34·94	41·32	49·72	69·86	40·33
1932 ..	134	2,003	33·67	38·22	49·28	51·93	38·11
Total ..	514	9,580	37·92	44·76	44·20	51·83	43·61
Number of farms			99	400	3	12	514
Acres			1,829	7,461	68	222	9,580

Table 4.—Grading of Product (No. 1 Grade).

Year.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1930 ..	159	3,088	95·03	79·00	100·00	100·00	81·45
1931 ..	221	4,489	39·42	49·64	100·00	100·00	48·91
1932 ..	134	2,003	45·83	52·71	100·00	83·38	54·78
Total ..	514	9,580	57·18	62·11	100·00	89·50	62·48
Number of farms			99	400	3	12	514
Acres			1,829	7,461	68	222	9,580

DUNSANDEL DISTRICT.

Table 5.—Yields per Acre.

Year.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1930 ..	15	368	51·69	53·50	45·83	..	52·65
1931 ..	22	469	40·26	35·75	28·16	..	35·78
1932 ..	6	116	..	24·28	..	..	24·28
Total ..	43	953	44·39	40·77	38·46	..	40·9
Number of farms			6	34	3	..	43
Acres			72	821	60	..	953

Table 6.—Grading of Product (No. 1 Grade).

Year.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1930 ..	15	368	100·00	80·66	100·00	..	83·61
1931 ..	22	469	87·04	26·57	Nil*	..	32·13
1932 ..	6	116	..	46·02	..	..	46·02
Total ..	43	953	92·49	54·76	69·50	..	58·72
Number of farms			6	34	3	..	43
Acres			72	821	60	..	953

* None passed as No. 1 Grade.

LINCOLN DISTRICT.

Table 7.—Yields per Acre.

Year.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1930 ..	48	571	53·77	53·08	36·63	34·42	50·60
1931 ..	52	771	52·65	42·03	33·38	51·62	44·97
1932 ..	42	365	46·45	35·56	32·63	..	39·14
Total ..	142	1,707	51·54	44·27	34·14	44·06	45·60
Number of farms			53	65	20	4	142
Acres			564	889	179	75	1,707

Table 8.—Grading of Product (No. 1 Grade).

Year.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1930 ..	48	571	81·98	71·10	100·00	100·00	78·45
1931 ..	52	771	91·21	61·95	62·19	Nil*	67·99
1932 ..	42	365	70·52	5·00	46·74	..	40·29
Total ..	142	1,707	83·20	56·93	69·83	34·38	66·80
Number of farms			53	65	20	4	142
Acres			564	889	179	75	1,707

* None passed as No. 1 Grade.

NORTH CANTERBURY DISTRICT.

Table 9.—Yields per Acre.

Year.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1930 ..	5	128	..	41·50	..	57·36	52·41
1931 ..	8	182	..	35·00	..	49·95	45·35
1932 ..	4	123	27·00	15·00	..	48·93	28·82
Total ..	17	433	27·00	29·00	..	52·32	42·74
Number of farms ..	..	..	1	6	..	10	17
Acres ..	..	..	20	156	..	257	433

Table 10.—Grading of Product (No. 1 Grade).

Year.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
1930 ..	5	128	..	Nil*	..	46·35	34·88
1931 ..	8	182	..	64·29	..	27·14	35·96
1932 ..	4	123	Nil*	Nil*	..	Nil*	Nil*
Total ..	17	433	Nil*	27·88	..	24·06	28·68
Number of farms ..	..	1	6	..	10	17	
Acres ..	..	20	156	..	257	433	

* None passed as No. 1 Grade.

SUMMARY OF DISTRICTS, 1930, 1931, 1932.

Table 11.—Yields per Acre.

District.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Ellesmere ..	514	9,580	37·92	44·76	44·20	51·83	43·62
Dunsandel ..	43	953	44·39	40·77	38·46	..	40·90
Lincoln ..	142	1,707	51·54	44·27	34·14	44·06	45·60
North Canterbury	17	433	27·00	29·00	..	52·32	42·74
Total ..	716	12,673	41·12	44·10	37·21	51·00	43·65
Number of farms ..	..	159	505	26	26	716	
Acres ..	..	2,485	9,327	307	554	12,673	

Table 12.—Grading of Product (No. 1 Grade).

District.	Number of Farms.	Acres.	Chevallier.	Spratt-Archer.	Goldthorpe-Spratt.	Plumage Archer.	Total.
			Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Ellesmere ..	514	9,580	57·18	62·11	100·00	89·50	62·48
Dunsandel ..	43	953	92·49	54·76	69·50	..	58·72
Lincoln ..	142	1,707	83·20	56·93	69·83	34·38	66·80
North Canterbury	17	433	Nil*	27·88	..	24·06	28·68
Total ..	716	12,673	66·05	60·64	77·70	54·79	61·69
Number of farms ..	..	..	159	505	26	26	716
Acres ..	..	..	2,485	9,327	307	554	12,673

* None passed as No. 1 Grade.

From detailed observation of the foregoing crops before and after harvest, combined with the information given in the tables, it seems clear that in order to obtain the best results from Spratt-Archer and Plumage Archer it is necessary that both the varieties should be sown on heavy land only.

Limited space precludes detailed comment on each table, but the tables are so drawn up that the grower may refer to any variety in any particular district. The results show the importance of sowing only smut-free seed of the purest strains on land suitable for its production.

SOAKING OF PASPALUM SEED PRIOR TO SOWING.

TRIALS have been made with various lines of paspalum seed, the results of which indicate that while soaking does not result in any significant increase in the total percentage of germination it certainly does materially increase germination speed. It was found, however, that temperatures over 60° centigrade (140° Fahrenheit) depressed germination, and that temperatures over 70° C. (160° F.) were totally fatal.

An immersion for five minutes at 60° C. gives good results, but an eighteen to twenty-four hours' soak at approximate room temperature is equally successful, and attendant with no risk of damage as is the case when soaking at high temperatures for prolonged periods.

—N. R. Foy, Seed Analyst, Plant Research Station.

Top-dressing of Chewings Fescue for Seed.—Officers of the Fields Division report good results from this practice in Southland during the past season. Some fescue paddocks near Gore top-dressed with lime about three months before closing up for seed, and then top-dressed with sulphate of ammonia at 1 cwt. per acre just before closing up, showed a great response in seed yield. At Nightcaps 1 cwt. of sulphate of ammonia per acre on an area of 30 acres of fescue, top-dressing in spring, produced 97 bags of seed. The same area not top-dressed in season 1930–31 produced 45 bags, and in season 1929–30 60 bags. Top-dressing of the pastures with superphosphate was also carried out.

SEASONAL NOTES.

THE FARM.

Pasture Establishment.

UNDER a wide range of conditions pasture-seed mixtures often may be sown suitably in September. To obtain the greatest assurance of maximum success from the sowing of pasture seed several matters require careful attention. Of outstanding importance is the use of suitable strains of the plants being sown. As yet differences between strains of the one species are of most marked practical importance in what is loosely known commercially as "perennial" rye-grass—the term being used in this relation to embrace not only material which is truly perennial, but also material which is definitely short-lived in character.

In those extensive districts with a rainfall, say, of 35 in. or more, which favours the growth of rye-grass, there is no need to demonstrate the value of being able to ensure its permanence in swards of long duration. But the advantage of using truly perennial rye-grass in drier districts seems not to be so clearly understood. Because of this, about two years ago the Department of Agriculture inaugurated trials in Canterbury for the purpose of comparing the carrying-capacity of swards containing different types of rye-grass. A recent interim report on five of these trials, in all of which grazing is carried out by sheep, provides instructive data. During the first period, which covers approximately a year, 130 days of grazing were obtained on the plots containing true perennial rye-grass for every 100 days of grazing obtained on the companion plots containing the non-perennial type. In the second period, which covered a portion of the second autumn in the life of the sward, the factor of permanency of strain began to operate more strongly, with the result that 186 days of grazing were obtained on the plots containing true perennial rye-grass for every 100 days of grazing obtained from the companion plots. These data indicate differences in carrying-capacity of a kind which has been repeated in a manner readily visible on many trials of a similar type throughout the Dominion. Differences of similar practical importance are found to occur between various strains of such important pasture species as white clover and cocksfoot, and almost invariably imported seeds of these species are definitely inferior to seed of New Zealand origin.

The practical application of our current knowledge of strain differences in species of pasture plants is the use in seed mixtures of only true perennial rye-grass, New Zealand cocksfoot, and New Zealand white clover. At times, and especially in respect to perennial rye-grass, the price of the superior strain may seem to be disproportionately high, but when it is kept in mind that the use of inferior strains is likely to lead either to a long period of unnecessarily depressed yield or to unnecessarily early breaking-up and resowing of the sward, then the comparatively high cost of the superior strains of seed will not seem sufficient to justify dispensing with their use. If supplies of true perennial rye-grass are not conveniently obtainable by the purchase of certified seed, then it becomes advisable to resort to lines of seed of which it can be ascertained reliably that they have reacted favourably under the special ultra-violet light test carried out by the Department of Agriculture.

Another factor of importance in the purchase of pasture seed, and incidentally of practically all kinds of seed, is its "real value" ascertained principally by consideration of its germination capacity and purity. It seems such an obviously common-sense proceeding to buy comparatively

expensive seeds only on the basis of their content of live seeds of the sort to be sown that it is really surprising that farmers generally buy their seeds in a blind fashion. Farmers would do well to remember that they seldom can sell their seeds really advantageously in a similar fashion. The two principal points which seem to be generally overlooked by farmers are, firstly, that the appearance of most seeds is a very incomplete indication of their real value; and, secondly, that farmers by taking suitable simple steps may obtain gratis through the activities of the Seed-testing Station all the information they need about seed they contemplate using. In this connection it may be worth noting that certified seed is not at all necessarily of good germination or purity, and so, especially on account of its relatively high price, its purchase should be based at least partly on a knowledge of these qualities—knowledge which should be readily procurable from the vendors of the seed, as this information is officially supplied to the owners of the seed at the time of certification.

Pasture Seed Mixtures.

The following three seed mixtures will suitably cover the requirements of the great majority of farmers:—

(1) For a temporary pasture of one to two years' duration: Italian rye-grass, 25 lb. to 30 lb.; red-clover, 6 lb.—total, 31 lb. to 36 lb., per acre. Temporary pastures that such a mixture would provide are of considerable value as a means of spelling and building up the fertility of land which has been impoverished to some extent by a period of cultivation, and as a means of freeing land of weeds, such as blackberry, prior to the sowing of a permanent pasture. In general, temporary pastures are most effective when sown in the autumn, as they are then likely to be of special value in providing additional feed for winter and spring, but they are also at times quite useful when sown in the spring following a root or other special crop such as swedes, chou moellier, &c.

(2) For what are called short-rotation pastures that are intended to have a life of two or three years: Italian rye-grass, 15 lb.; perennial rye-grass, 15 lb.; red clover, 4 lb.; white clover, 2 lb.—total, 36 lb., per acre. Short-rotation pastures are most generally of value on farms on which, mainly because of climatic conditions, cereals and other arable crops instead of pastures are the principal considerations.

(3) For pastures which are intended to occupy the land as permanently as possible the following mixture is recommended by Mr. E. Bruce Levy, Agrostologist, as suitable for use over wide areas in both North and South Islands: True perennial rye-grass, 20 lb. to 25 lb.; New Zealand cocksfoot, 10 lb. to 15 lb.; crested dogstail, 3 lb.; timothy, 3 lb.; New Zealand white clover, 2 lb.; red clover, 3 lb.—total, 46 lb., per acre. This mixture is recommended for use on country with a carrying-capacity which is, or can economically be increased to, one cow to 2 or 3 acres or better, or two to three ewes to the acre or better. The larger amount of cocksfoot is to be used only when the smaller amount of rye-grass is used, and the latter is advisable either when the summer rainfall is below that needed for good results with rye-grass, as under Canterbury or similar conditions, or when it would not be economical, even though the rainfall is sufficient, to raise the fertility of the land by top-dressing up to good rye-grass standard.

Under certain special conditions modifications of the above seed mixture for permanent pasture may be desirable. The most important of the modifications are: (*a*) Poa trivialis at the rate of 2 lb. per acre should be included on country which is of good quality and which is comparatively damp in winter. (*b*) On fertile swamps which are too wet in the winter for success with rye-grass, and which cannot readily be drained sufficiently, meadow foxtail at 6 lb. per acre should be included; but if it is at all possible to drain the land enough to make it suitable for rye-grass this

should be done in preference to sowing the meadow foxtail. (*c*) In many relatively mild northern districts of the North Island paspalum at 6 lb. to 8 lb. per acre may at times advantageously replace cocksfoot.

As a rule permanent pastures are most successfully established when sown without companion crops, which somewhat misleadingly at times are called " nurse " crops. If these are good vigorous crops they are likely to weaken the young pastures by overshading, rather than to assist them.

Provision of Special Feed.

One of the most important objectives of spring field-work should be the eventual provision of ample reserves of feed for use during those times when the feed directly available from pastures is less than the requirements of stock. For use in the winter period, mangels, carrots, chou moellier, swedes, and turnips are all suitable. Except in the more severe and southern districts, mangels give excellent returns when accorded good fertility and good cultivation. They are extremely reliable, being practically free from attacks of any serious disease; they can withstand dry periods relatively well, and under suitable treatment their total yield of nutriment per acre is very high. Because of these facts they should be grown much more extensively than in the past.

Swedes and turnips may often fittingly replace mangels when the farming is of a more extensive type so that the good treatment desirable for mangels cannot really be accorded a crop. Carrots are suited to free fertile soils on which, as Taranaki results demonstrate, really good yields can be obtained. Chou moellier rightly has won considerable popularity in recent years for use on good ground, especially on ground that is inclined to be so wet at the time of feeding-off as to make the use of swedes not altogether suitable. Chou moellier is also very suitable when club-root infection is known or expected to be present in the land to be cropped—the plant, though not completely immune, being very resistant to attacks of this serious disease. For use in summer rape and soft turnips rightly have a wide vogue, and in the warmer districts green maize and millet, provided they are utilized when in a young leafy stage, are fitted to give good results.

Cultivation for all these crops should be proceeded with as early as possible. Cultivation subsequent to ploughing is usually very valuable not only in mellowing the soil, but also in destroying crops of weed seedlings which at times develop in great numbers.

The establishment of a stand of lucerne is a most important matter to which greater attention could well be given at this season. Much information about lucerne culture is provided in the Agriculture Department's Bulletin 155, obtainable on application.

Fields for Ensilage and Hay.

Haymaking and especially ensilage are important means of obtaining reserves of feed for which preparation may be commenced at this season. Fields intended for either practice should be thoroughly cleaned off and closed up as soon as they can be spared from grazing. All material such as wire, timber, &c., likely to cause delays or breakages in mowing should be carefully removed. Early closing up of such fields is valuable in that it favours the possibility of early mowing, which in its turn gives greater probability of a good aftermath that is generally markedly useful when the dry summer weather makes its effect felt. A top-dressing with superphosphate at closing-up time of fields intended for ensilage or haymaking is often advisable, especially in the case of fields not recently top-dressed.

September is often also a suitable time to close up lucerne areas. It assists greatly in obtaining a comparatively early cut which is suitably saved as silage, followed by a second cut at about New Year which is

valuable either for hay or green feed. The general result of early closing of lucerne and the conservation of the first cut as silage is an extra cut from the lucerne annually.

General Cropping Work.

Last month's notes relative to cropping generally are applicable broadly to the work requiring attention in September. Tine harrowing of land occupied by cereals sown in autumn or winter may be advisable for the purpose of loosening the surface of land which has become caked. Grass or cereal crops cannot safely follow a previous grass or cereal crop which was attacked by the grass-grub.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Spring Spraying.

WHERE spring sprayings of bordeaux mixture have not been applied in accordance with the directions given in last month's *Journal* no time should be lost in making the application.

Apples and pears: Among the more prominent ailments of apples and pears which require control by spraying between now and the blossoming period are black-spot and powdery mildew, and red mite and scale. For the fungus diseases foundation sprays of bordeaux 5–4–50 or lime-sulphur 1 per cent. should be applied at bud-movement, and again at the pre-pink stage, but reducing the strength of the lime-sulphur to 0·2 per cent. Should powdery mildew be very troublesome lime-sulphur is the best remedy, and it is very necessary to close up the gap between the last pre-blossom spray and the calyx application. During this period the leaves are emerging very rapidly and require a protective covering. To reduce this gap apply a 0·2 per cent. lime-sulphur spray as late as possible before blossoming and bring forward the calyx spray, not waiting for the whole of the petals to fall. Included in the calyx spray will be lime-sulphur 0·1 per cent. and 2 to 3 lb. of a colloidal sulphur. For the satisfactory control of mildew the trees must be made as vigorous as possible by efficient cultivation, manuring, and irrigation.

The strengths of lime-sulphur given above are in terms of the polysulphide content of the particular lime-sulphur which the grower may be using, and for which a table of dilution was given by Dr. G. H. Cunningham on page 265 of the April issue of the *Journal*. As this method of calculating the amounts of dilution for the different lime-sulphurs is a complete change from former practice, the following examples may be of considerable assistance to growers. The strengths suggested for the different periods of growth are: Dormancy to bud-movement, 1 per cent. polysulphide content; green-tip to pre-pink, 0·2 per cent.; summer, 0·1 per cent.; for autumn use on apple varieties susceptible to spray injury, and for stone fruits, 0·083 per cent.

Taking two examples of lime-sulphurs, one with a polysulphide content of, say, 19 per cent. and the other of 12 per cent., the necessary strengths for application to the trees at the different stages of growth would be as follows:—

Polysulphide Content Percentages.	1 per Cent. Dormancy to Bud-movement.	0·2 per Cent. Green-tip to Pre-pink.	0·1 per Cent. Summer.	0·083 per Cent. Autumn Applications on Susceptible Apple Varieties and for Stone Fruit.
19	1 in 19	1 in 95	1 in 190	1 in 228
12	1 in 12	1 in 60	1 in 120	1 in 144

For the control of red mite and scale insects some growers still prefer to apply a dormant or semi-dormant red-oil emulsion at a strength of 1 in 10 to 1 in 20; others are relying on the summer oils, which have really given the best control.

Cultivation and Irrigation.

Those who have not yet turned under their green crop should do so without delay. The soil should now be disked into a fine tilth as soon as it is fit to work. The disks, cultivators, and harrows must be freely used to keep the soil firm yet open so as to retain the moisture as long as possible. In those districts where irrigation is a general practice, watering should start much earlier than is generally the case. Water is abundant in the early part of the season, and should be availed of to put the necessary reserve of water into the soil. The result would be a better start for the trees in the spring, the greater certainty of any manures that have been applied being rendered available for the tree's use, the greater ease of applying later waterings, and the lesser quantity required to keep the soil moist. Delaying as late in the spring as possible before commencing to irrigate is bad practice. After the exceptionally dry autumn and winter experienced in Central Otago, irrigation should be commenced there as early as possible.

The Orchardist's Nursery.

No delay should occur in the planting of stocks which have been procured from elsewhere; they should now be in the nursery rows. The soil round these and any cuttings that have been set out should be kept in good tilth and free from weeds. Every effort should be made to keep the trees growing vigorously, so that they may be in a condition to bud next autumn. As explained in last month's notes, plum, apricot, and peach stones should have been sown, the latter for transplanting into nursery rows as soon as they are through the ground and large enough to handle. Any misses of apples and pears budded last autumn should be grafted with scions which have been kept dormant, when the stock has definitely commenced growth and the sap is running freely.

Through an oversight, the raising of apple-stocks was omitted from last month's notes; however, in most districts it may not be too late if they are attended to immediately. The present system in New Zealand is to work apples on to a "blight-proof" stock—that is, on apple roots that are resistant to the attack of woolly aphis. Northern Spy is the stock which has been used for many years in this country. To raise these stocks roots are taken from trees that are known to be on the desired stock. The best size of root is about the thickness of an ordinary lead pencil. Cut these roots into lengths of about 3 in., keeping them moist by placing them immediately into a box and covering them with damp moss or grass. In this way they will hold without drying out for some days. Procure scions of Northern Spy wood, which should not be thicker than the roots on which they are to be grafted. Cut the scions into 3 in. or 4 in. lengths—four buds. The whip or tongue graft is used for this grafting, and in doing so allow for the bottom bud of the scion to be near the bottom, so that when the scion is fitted to the stock this lower bud will be opposite the lower end of the union. Every effort must be made to obtain a good fit between scion and root. They are then firmly bound together with raffia, no wax being required. At times this grafting is done in the winter, and in such cases the grafted roots are bedded into soil until the ground is ready. If they are to be planted out within a few days, they can be placed in a box and covered with moist moss or grass or damp sand as mentioned above. In neither instance must the stock or scion (either before or after grafting) be allowed to dry. The soil where the grafted roots are to be planted must be well worked down and in good condition before planting. They are planted out in

nursery rows somewhat as advised for cuttings, but as the root grafts are less than half the length of the cuttings, the firm bottom on which they rest will be shallower. They are planted in rows 1 ft. 6 in. apart and 3 in. to 4 in. between the plants, as they will be lifted and replanted next season. They should be planted with about 1 in. of scion showing above the ground, which is trodden firmly as with the cuttings.

Miscellaneous.

Planting and pruning should now have been completed, and all prunings, rubbish, &c., burned. If through any cause trees for planting have arrived late, give them a good watering after planting before placing the final loose soil on top.

Potash and phosphate manures should also have been sown, but should this not have been done they may still be applied. Sulphate of ammonia or nitrate of soda may be applied shortly; for preference the former should be sown at green-tip and the latter at pink.

Watchful care must be kept for fireblight. Wherever it is noted cut back limb or shoot well below the infected area, all tools used being efficiently disinfected.

— W. R. L. Williams, Orchard Instructor, Alexandra.

Citrus Culture.

Owing to the showery and spring-like conditions obtaining during the autumn, a fair amount of young growth was produced in many citrus orchards which had no time to harden before the winter set in. It is possible that some of this growth will have been damaged by frost, and it will not be wise to cut such parts back until all danger of frost is over. The work should not, however, be unduly delayed, as dead and dying wood is always more or less injurious to any growing trees.

A careful watch should be kept for any indication of borer and all cavities should be treated with an injection of benzine, afterwards blocking the hole with soap or some other plastic material. If small branches only are infested it may be more advisable to cut them out and burn.

During the coming month, if weather and other conditions are suitable, it may be necessary to consider cultivation. Ploughing is essential in order to turn under green crops, if they have been grown, or weeds that may have been produced. Do not plough deeply, as this will only cause undue injury to the roots. Ploughing in good time gives the land a chance to dry and become in a more suitable condition for development of the roots, this being reflected in the growth and vigour of the trees.

A sharp look-out should be kept for the appearance of scale insects, and the fact noted in order that they may be dealt with when the weather becomes warmer. Spraying for their control is better delayed until well on in the spring.

Continue gathering lemons as they reach the required size. By doing this the trees have a much better chance of producing a uniform fruit. Do not try to market any fruit that has been damaged by the frost, as this will only tend to cause buyers to dislike the New-Zealand-grown article. When lemons have been affected by frost they lose their juice content, and when cut have a very dry appearance.

— L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

The Hatching of Ducklings.

THERE is yet ample time to hatch out ducklings for the renewal of the laying flock, but September should see all eggs undergoing the process of incubation for the production of ducklings for the Christmas market. To

cater for this market the eggs should be put down about fifteen weeks before the young birds are to be marketed. This will allow twenty-eight days for hatching (the natural time), and the remainder for rearing the birds to prime condition.

A point may be mentioned here in regard to mating ducks. They should be mated well in advance of the time when the eggs are required for hatching purposes, or a large proportion of infertile eggs may be expected. Ducks, especially the heavier breeds, have usually to be mated much longer than fowls in order to ensure a maximum number of fertile eggs. In mating Indian Runners one drake to six ducks, and for the heavier breeds one drake to four ducks, are the proportions for breeding purposes at this period of the year, but during the summer or natural laying season the number of ducks may be considerably increased. The amount of range provided and also the vigour and health of the males must be considered in mating operations. When the drakes commence fighting it is usually an indication that more ducks are required in the breeding-pen, or that the number of drakes should be lessened. Good fertility can be obtained from Indian Runners when they are kept away from water, but for the heavier breeds better results are obtained if water is provided.

Where incubators are used for hatching purposes, the temperature to be maintained is 102° F. for the first week and 103° for the remainder of the incubation period. It is a good plan to spray the eggs with water at a temperature of 103° every morning after the fourteenth day. The water may be applied by means of the mouth or a fine florist's spray. Immediately the eggs are taken out of the machine they should be quickly turned, sprayed, and replaced in the incubator. Never cool after spraying, but spray in the morning and cool at night. The incubator vents should at all times be partly open, so that any excessive moisture, not absorbed by the eggs can escape. Generally speaking, no further moisture is required. The spraying of the eggs not only has the effect of bringing the air-cell down to a desired line, but also softens and weakens the membrane lining of the shell, which assists the young duckling to emerge. The period of incubation for duck eggs is twenty-eight days, but the ducklings commence to pip on the twenty-sixth day, and therefore the novice must be careful not to try and help the young birds out of the shell until they have been given their full time to hatch out.

Do not feed the young birds for the first twenty-four to thirty-six hours after hatching. For the first few days give equal parts of bran and pollard, mixed with a small quantity of oatmeal and 5 per cent. of finely broken sea-shell and gravel grit (not sand), the whole to be moistened to a desired consistency with skim-milk or hot water. After the first week, finely cut green material, such as silver-beet, lettuce, succulent grass, oats, watercress, &c., must be fed daily. When the ducklings are about ten days old 5 per cent. of minced boiled meat may be added to the mash mixture, and this proportion should be increased up to 10 per cent. as the ducklings develop. After the first week the oatmeal may be dispensed with, and white ground wheat, barley, or oats with the husks screened out may be included in the mash. Feed four times a day, as much as the birds will pick up clean. Ducklings should be fed from troughs, otherwise much of the food will be wasted. After the young birds are a week old do not mix the grit with the food, but keep it within easy reach so that they can help themselves.

The drinking-vessels should be sufficiently deep to allow the ducklings to clean out their nostrils and so prevent the latter from becoming clogged up with food, &c., as this is a common cause of the eyes becoming plastered and of the weakening of the legs and back, as well as other troubles. Some fine gravel placed in the drinking vessel will greatly assist in moving any food or dirt from the nostrils. During the brooder stage, ducklings should have drinking water available to them night and day. If after a long fast

water is supplied, and especially before the birds have been given a meal, fatal results are almost sure to follow. The affected ducklings will be observed to stagger, fall on their backs, and appear to be in a fit, when death soon follows. Where it is found that the drinking vessels are empty, and the birds have been without water for some time, it is a good plan to take the chill off the water before giving it to the birds to drink.

Never allow ducklings to sleep on damp or wet bedding, as this is a common cause of leg weakness, and once a duckling becomes affected in this way little or nothing can be done for it. It is really a matter of prevention by checking everything that tends to create a moist atmosphere. The first essential to this end is to place the water-vessels well away from the sleeping-quarters, so as to prevent the bedding-materials from getting wet.

Young ducklings should be always protected from hot sun, as they have thin skulls and are very prone to sunstroke, which is a common cause of heavy mortality. Good shade is the secret for preventing this trouble.

In rearing ducklings, no matter what class of brooder is being used, care must be taken to provide the young birds with an ample supply of fresh air. Without this the mortality is sure to be great. Good ventilation should go hand in hand with a uniform degree of warmth—say, a temperature of 90° at the start and reducing this gradually as the ducklings develop.

Provision of Green Feed.

Every effort should be made to grow an abundant supply of green material for future use. Green feed serves a threefold purpose, for it not only keeps the fowls in good health and gives the yolk of eggs the desired rich colour, but it materially assists in reducing the grain bill and thereby makes for economical production. It cannot be too strongly emphasized that for young stock to make the best growth they must never receive a set-back, and one of the worst checks to healthy development is lack of green stuff during the growing stage. Silver-beet is an excellent thing to grow for poultry, and is a heavy cropper. Any of the cabbage family, including rape, or alternatively mangels, carrots, and green oats, may be grown to advantage. In these days of high cost of grain materials, it will pay well to feed green material with a free hand, particularly where growing stock are concerned.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Uniting Weak Colonies.

Normally, at this season of the year there are usually large patches of brood in the hives. A further examination may be carried out where the beekeeper was in doubt on the previous occasion as to the hive being queenless or not. The absence of brood at this season will denote a poor queen or that the hive is queenless. In either case it is advisable to unite with another hive. This should be done immediately, as a queenless hive stands in great danger of being robbed by other bees in the apiary. A ready method of uniting is by placing the weak colony over a strong one on the stand of the latter, with a sheet of newspaper between the two hive-bodies. They may be examined after a couple of days to see if things are going well, and if the paper is not bitten through it should be torn in several places. In another day or two the united colonies will be working peaceably. In the case of the weaker colony it is wise to kill the queen before uniting.

At this examination the beekeeper must keep a strict watch for symptoms of disease. If foul-brood is discovered in a mild form the colony should be marked for treatment later in the season. Should, however, the colony be badly affected it is advisable to sulphur the bees and destroy the combs. Care should be taken to remove the hive to a place of safety until it can be properly cleansed.

Overhauling the Hives.

In August a great deal of the preliminary seasonal work of the apiary may be done. Each hive should receive a good coat of paint. This will help to preserve the timber, besides giving the hives a neat appearance. The bottom-boards should be scraped clean. During the winter months there is usually an accumulation of cappings, pollen, and dead bees, and if left this becomes a harbour for woodlice, which are very objectionable. A simple plan is to provide a spare bottom-board. Lift the hive on to the spare one, scrape the old board, and replace the hive. Remove all top boxes, as advised last month, and make the bees snug and warm for brood-rearing. Remove all weeds and long grass from round the hive. Long grass keeps the hives and bottom-boards damp, and acts as a harbour for insects.

Cleansing Hives and Frames.

The beekeeper should not fail to cleanse all hives and frames that have been in contact with diseased colonies. This work may be undertaken now, and the hives and frames prepared for future use. Where there is only a small number of frames to be cleansed it is hardly worth while to attempt to save them. However, if much material has to be treated the saving effected will more than pay the beekeeper for his time and labour. There are several methods for treating hives and material, but perhaps the simplest and most effective is the use of boiling water and caustic soda. Many beekeepers recommend the use of a painter's blow-lamp, but this tool is not always handy, and, besides, the charring of the hives is an advertisement for all time that they once contained diseased bees.

The most suitable vessel for cleaning frames is an ordinary washing-boiler. To every 8 gallons of water add 1 lb. of caustic soda, and allow to boil. The frames may be tied in bundles of six and immersed in the liquid. The caustic soda attacks the propolis and wax, and this immediately floats on top of the water. Three to five minutes' immersion will serve to cleanse each bundle of frames. Skim the refuse from the top of the water frequently, and as the solution weakens add more soda. Stack the frames in supers and place in the sun to dry. The hive-bodies and bottom-boards may be cleansed by means of a swab. Immerse the swab in the boiling water, and carefully wash the inside of the hives. Care must be taken when using caustic soda, as it is liable to burn the hands.

Prevention of Robbing.

A strict watch should be kept for robbing. This is most likely to occur when feeding has to be undertaken, and once started it is about the hardest matter to cure. Feed only in the evening, if possible, so that the excitement created by the supply of warm syrup will have died down before morning. Keep the entrances to all hives contracted, and see that there are no cracks through which a robber could possibly enter. Perhaps the main cause of robbing, however, is the presence in the apiary of queenless or weak colonies. If the bees once discover a queenless hive there will be no peace until the source of trouble is removed. The inmates of such a hive will not defend their stores as bees in a normal condition will, and unless the colony is united with another it will tend to demoralize the rest of the apiary, until none but strong colonies will be safe from the depredations of the robbers.

Where a weak colony is in danger of being attacked, and where the beekeeper is satisfied that it is worth saving—that is, if he considers the queen good enough to build up a strong colony by the time the main honey-flow sets in—his best plan is to pile wet grass on the alighting-board and well up above the entrance, keeping the grass wet for a day or two, and painting any cracks in the hive with kerosene or carbolic solution. This treatment will soon settle the robbers and restore peace in the bee-yard. However, the best thing to do with weak colonies is to unite them without delay with stronger hives. Like most other troubles, though, prevention is the best thing when dealing with robbers. Do not spill any syrup near the hive, do not leave any combs lying about, and do not have any weak colonies, and you will not be troubled with robbing.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Small Fruits.

LIGHT cultivation in fine weather to suppress weeds, and the application of chemical sprays as may be necessary to keep the plants free from the attack of fungus and insect parasites, is the chief work in this section at present. Where new plantations of bush fruits have been made a little judicious intercropping may be done, so as to enable some return from the land to be obtained this season, so long as the welfare of the permanent crop is not interfered with.

Towards the end of September is the season for planting out or sowing passion-fruit. In the light of experience on larger acreages some modifications in the construction of the trellis and spacing the plants have been suggested, as follows: The posts of the trellis should be 5 ft. out of the ground and 2 ft. in; they should not be more than 27 ft. apart, with the end posts well strutted. The top wire should be double, one on either side of the post, and another wire 3 ft. below—that is, 2 ft. from the ground. There should be 9 ft. between the rows of plants and the plants set 10 ft. apart beneath the trellis, requiring about 480 plants to the acre. Where each plant is to be set a light stake should be inserted and tied for security to one of the wires above. The plants should be set firmly in position, one at the foot of each stake to which it should be tied as growth is made. Any lateral growth developing should have the top nipped off after three or four leaves have been formed. Under this treatment a single vine is run up quickly to the double top wires, where it should be stopped and four leaders encouraged to develop, two being trained in on the top wires, both to the right and left of the stake. In this way the permanent framework of the vines is developed, and laterals from it, formed annually, bear the fruit, after which the bearing laterals should be cut back to just beyond the second bud from the base.

The Tomato Crops.

Successful cropping under glass depends chiefly on good management at the present time. This has to do mainly with close attention to the important requirements of air and water. Extreme temperatures, either way, should be avoided. When water is necessary it should be tepid and applied during the morning. If a thorough soaking was given before planting little will be required, generally, for some time. The same remarks apply to boxes of seedlings, in the frames, which are being raised for planting outside. When the plants which are to fruit under glass form their first truss of blossom, the setting of the fruit will be assisted materially if the

plants are shaken to distribute the pollen. This is usually done about midday, in fine weather, by jarring the strings to which they are attached.

Late frosts have caused damage in some districts, during recent years, to crops under glass. In the absence of a hot-water heating-system the best policy is to keep the plants sturdy by avoiding excessively high temperatures, and have them in dry condition at night by watering in the morning. In extreme cases some kind of emergency heating may be required, but it must be such as will not liberate dangerous gases liable to cause more damage than the frost. If a crop under glass should be struck by frost the damage may be lessened by spraying with whitewash the outside of the house before the sun strikes it. By thus shading the crop and regulating ventilation to avoid a sudden rise in temperature, a quick thaw, which is so damaging, will be avoided.

Land for the outside crop should be prepared in dry weather so soon as it is available. In doing this if ¼ lb. of bonedust per square yard is ploughed under it will generally be beneficial.

Vegetable Crops.

At this period the end of the harvest of winter cabbage and broccoli is approaching, and that of spring cabbage and cauliflower is about to commence. The quality of winter root crops will be falling away, except that of autumn-sown shorthorn carrots, which are often dug now in very nice condition. Good spinnach, celery, and leeks will often be available, but with the return of warm weather they will commence to bolt. Most important is the asparagus crop, the harvesting of which will now commence; with rhubarb it supplements rather well the comparatively lean resources of the garden at this season.

Young plants set out should be weeded by hoeing in fine weather. It is less costly if this is done before the weeds form their second leaves. Seedling crops will require the same attention as soon as they germinate and the rows can be distinguished. Until the plants meet overhead this weeding must not be neglected if a good crop is to be obtained.

Main crop potatoes, cabbage, and cauliflowers should now be planted. The sowings for the month will consist chiefly of main crop carrots, beetroot, peas; salads, turnips, and parsley; and, towards the end of the month, leeks and celery. Where birds or mice may be troublesome peas should be given a dressing of kerosene and red-lead before sowing them.

Land should be prepared for the half-hardy crops of dwarf and runner beans, marrows, pumpkins, cucumbers, and melons to be sown next month. An early crop of small marrows is always very much appreciated, and in warm localities where they may be grown they should be started as soon as possible; in some instances the plants may be raised in boxes and planted out with advantage.

The Homestead Garden.

The planting of trees and shrubs should now be completed as soon as possible, as the planting season for hard-wooded plants is now drawing to a close. The pruning of evergreen shrubs may now be done; chiefly this will consist of thinning out the growth where it is crowded, and the removal of dead wood.

Lawns will require considerable attention now for a while. They should be cut when the grass is dry, and the verges trued up where they have spread. Two or three small applications of sulphate of ammonia at intervals of about three weeks will suppress weeds and clover and improve the grasses; it is best mixed with sand before applying it. Most lawns would benefit, on light land especially, from more frequent rolling now; for this operation the grass should be dry. Where the land is heavy and wet there is danger, if too heavy a roller is used, of consolidating the soil

to the extent of interfering with drainage, and the turf will suffer from lack of air; this extreme should be avoided. New lawns should be cut with a mower with the knife raised so as to avoid the mistake of cutting too close. This should be followed up with the frequent use of a roller that at first does not exceed 2 cwt. This weight should be increased after several cuttings have been made, especially if the land is light. Good lawns and clean walks are the most important features in a well-designed garden, and they are in most places easily obtained with seasonable attention. A good week-killer applied to walks and drives now will keep them free from weeds for the rest of the season.

House plants requiring repotting or top-dressing should be given that attention now. Rooms, halls, and verandas in this country usually provide conditions for many handsome plants to grow to perfection. Begonia rex, asparagus, aspidistra, palms, ferns, cyclamen, cinerarias, and hydrangea grow best in rather shaded positions. Cacti and pelargoniums, zonal and regal, grow best where the conditions are dry and sunny. All house-plants require fresh air, but cold draughts quickly cause serious injury.

—W. C. Hyde, Horticulturist, Wellington.

SOME DAIRY-FACTORY DATA, 1931–32.

In the year ended 31st March, 1932, 99,548 tons of creamery butter and 83,299 tons of cheese were graded for export, the produce being manufactured by 370 companies operating 468 factories. Of these companies, 126 were engaged in buttermaking, 186 in the manufacture of cheese, and the remaining 58 made both butter and cheese.

There were 184 companies operating 207 factories making butter, of which 160 of the companies with 181 factories were co-operative, and the quantity of butter graded on their account was 90,959 tons, or 91·372 per cent. of the total. The remaining 24 companies were proprietary, operating 26 factories, and the quantity of their butter graded was 8,589 tons, equal to 8·628 per cent. of the whole. The average butter production per factory was 481 tons.

The cheese was manufactured by 244 companies operating 320 cheese and dual-plant factories. Of these companies, 233 were co-operative, operating 309 factories, and the quantity of their cheese graded was 81,756 tons, or 98·148 per cent. of the total. The remaining 1,543 tons, equal to 1·852 per cent. of the cheese graded, was made by 11 proprietaries operating 11 factories. The average production for all cheese factories was 260 tons.

Converting the amount of butter and cheese made to terms of butterfat, it is found that 82,957 tons of butterfat was represented in the butter, and 32,038 tons in the cheese, a total of 114,995 tons. Of this 107,244 tons, or 93·260 per cent., was manufactured by co-operative companies, and 7,751 tons, or 6·740 per cent., by proprietaries.

The total number of milk or cream suppliers to dairy factories for the year under review was 63,946, of which 54,675 supplied co-operative companies, and 9,271 proprietaries, equal to 85·502 and 14·498 per cent. respectively.

Included in the above were 84 companies operating 85 registered whey-butter factories, which made a total of 1,422 tons of whey butter (as a by-product of cheese manufacture) during the year.

—Dairy Division.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING JULY, 1932.

Aucklander Short-top (N.Z. Sutton's Supreme).

Rich, A. J., R.M.D., Kaiapoi.
Redmond, C., R.M.D., Kimberley.
Dyer, H., Southbrook, Rangiora.
Petrie, J., jun., Swannanoa. (Line B.)
Smith, E. A., R.M.D., Lincoln.
Cross, S., R.M.D., Weedon's.
McMullan, J. D., North Road, Kaiapoi.
Barnett, R., Dunsandel.
Mulcock, W. J., Ryan's Road, Christchurch.

Aucklander Tall-top.

Bailey, J., R.M.D., Kaiapoi.
Cross, H. E., Sandy Knolls. (Line A.)
N.Z. Loan and Mercantile Agency Co., Ltd., Christchurch.
Steele, J., R.M.D., Darfield.
Doak, A., Rangiora.
Crowe, E., Waimate.
Hills, W., Oxford Road, Rangiora.
Steele, D., R.M.D., Ohoka.
Watkins, E. R., Springbank, Rangiora.

Dakota.

Eder, W., R.M.D., Sefton.
Adams, D., Highbank, Methven.
Hinton Bros., Templeton.

Up to Date.

Manson, D. J., Enfield, Oamaru.
Gray, J. L., St. Andrew's.

Arran Chief.

Frazer Bros., Southbrook, Rangiora.
Watkins, E. R., Springbank, Rangiora.

King Edward.

Teschner, C. A., Chatton Road, Gore.

Epicure.

Barnett, R., Dunsandel.

Iron Duke.

Robinson, R. G., Box 4, Papanui.

Field Marshal.

Wright, L. T., Annat.

Northern Star.

Robinson, R. G., Box 4, Papanui.

NOTE.—Reference should be made to the full list of provisional certificates published in the June *Journal*, also to a list of crops passed tuber inspection in the July issue.

—*Fields Division.*

FERTILIZER IMPORTATIONS: JUNE QUARTER.

FOLLOWING are particulars of importations of fertilizers into New Zealand for the quarter ended 30th June, 1932 :—

Cyanimide, nitrolim, and calcium cyanamide : Norway, 5 tons. *Nitrate of soda :* Chile, 540 tons. *Basic slag :* United Kingdom, 2,094 tons ; Belgium, 22,420 tons ; France, 50 tons. *Guano :* United Kingdom, 10 tons. *Rock phosphate :* Ocean Island, 8,510 tons ; Nauru Island, 27,287 tons ; Tuamotu Archipelago, 7,077 tons. *Other phosphates :* Belgium, 650 tons. *Kainit :* Germany, 33 tons ; Poland, 75 tons. *Muriate of potash :* France, 25 tons ; Germany, 43 tons. *Sulphate of potash :* Belgium, 5 tons ; France, 5 tons ; Germany, 98 tons. *Sulphate of ammonia :* United Kingdom, 1,325 tons. *Other fertilizers :* United Kingdom, 10 cwt. ; Malaya, 100 cwt. ; Netherlands, 18 cwt.

—*Chemistry Section.*

Correction.—Commercial Fertilizers and their Basis of Sale : In the heading of Table 1, on page 19 of last month's *Journal*, giving the world production and consumption of pure nitrogen, the year should read *1930*, not 1931 as printed.

Granny Mac Apple.—The Orchard Instructor at Hastings reports : " About four years ago an orchardist in Hawke's Bay imported an apple-tree of the Granny Mac variety from Australia, and has since worked over a few more trees. A cross between Granny Smith and McIntosh Red, it was reputed to be highly coloured, but so far it has been very disappointing in this respect, most of the fruit being green, although a few specimens have had an attractive blush. The flesh is white and texture coarse. Maturing about the same time as Delicious, it does not appear to be as good a keeper. Although probably a good bearer, it has nothing outstanding to recommend it."

WEATHER RECORDS: JULY, 1932.

Dominion Meteorological Office.

THE month was a very dry one, possibly the driest July on record. Temperatures were much below average, especially in the North Island, but this was offset by an abundance of sunshine accompanied by an unusual absence of wind. Snow was rather frequent during the month on the high levels, but there were no very heavy falls in the interior.

Rainfall.—The only places where more than the average rain for July was recorded were in Southland, on the shores of Foveaux Strait; Invercargill, for instance, had an excess of 6 per cent. Everywhere else the rainfall was below normal. The departures from the average were fairly small on the east coast of the North Island, but in most other districts there were large deficits. In many cases the total was the lowest hitherto recorded. The interior and the northern and western portions of the South Island were particularly dry. Nelson, for example, had rain on only three days, and the total was only 10 per cent. of the normal. Still more remarkable was the Waiho Gorge total of 0·15 in., falling on only one day, compared with a July average of about 15 in.

Temperature.—Temperatures were practically everywhere below normal. The North Island fared relatively the worse, being on the average about 3° F. colder than usual. In the South Island the farther south one goes the nearer becomes the approach to normal. Ground frosts were very numerous and often severe, but as regards shade temperatures, there were no outstanding extremes.

Sunshine.—The records of sunshine were everywhere above the July average. Nelson had the remarkable total of 194·3 hours, Blenheim ran it close with 186·3 hours, and Hokitika had no less than 160·4 hours.

Pressure Systems.—At this time of year, the meteorologist expects well-developed storm systems moving with regularity from the westward and bringing widespread rains with them. It is usually the most satisfactory period for the forecaster. This year the reverse has been the case. The normal westerly depression associated with the prevailing north-westerly winds of this region has been conspicuous by its absence. North-westerlies predominated in New Zealand on only two days in July. The first of these was the 6th, when they were strong in Cook and Foveaux Straits, and the second on the 31st, when, though general, they were only moderate. In each case a slight westerly depression was passing to the south of New Zealand. The ruling depression was of the cyclonic type and the centres all took a northerly course, the tracks crossing the northern portion of the North Island or passing farther north still.

On the 9th a deep and extensive cyclone covered the Tasman Sea. When, however, the storm was due to pass New Zealand it filled up with extraordinary rapidity and by the night of the 11th it had passed without causing nearly such general rains or such stormy weather over the Dominion as might have been anticipated. There were, however, heavy rainfalls in the northern part of the North Island.

In the succeeding days a number of cyclones followed in the track of the one just mentioned. The majority were shallow, but one whose centre passed near Auckland on the 14th was fairly deep and strong southerly winds blew in its rear. Again, there were some heavy rains in the North, but much of the remainder of the country escaped altogether.

The only other vigorous depression was one which after passing to the north of Norfolk Island deepened and moved in an east-south-easterly direction during the 20th and 21st. This was followed by widespread snow.

From the 9th to the 28th inclusive the prevailing winds were from a southerly direction. Though not as a rule strong over the Dominion, to the eastward their speed increased, and the period was a very stormy one over ocean waters in that direction. A factor which contributed to this state of affairs was the persistence of low pressure in the Chatham Islands region from the 11th to the 27th. The low temperatures experienced were a natural consequence of the southerly winds. They were responsible also for changeable erratic weather. Showery conditions with frequent hail or snow on the high levels were the rule at places exposed directly to these winds. Such conditions were persistent on the coast south from Dunedin and on Banks Peninsula.

RAINFALL FOR JULY, 1932, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	3·30	14	1·21	5·63
Russell	4·85	14	1·64	5·30
Whangarei	5·21	17	1·51	7·28
Auckland	4·62	12	1·54	5·07
Hamilton	2·95	12	0·82	5·17
Rotorua	2·17	6	0·93	5·05
Kawhia	1·73	7	0·41	6·17
New Plymouth	2·33	14	0·52	6·46
Riversdale, Inglewood ..	2·79	11	0·98	10·21
Whangamomona	1·63	4	0·72	7·48
Eltham	2·63	8	1·04	6·06
Tairua	6·12	8	2·14	6·32
Tauranga	4·96	8	2·48	5·23
Maraehako Station, Opotiki ..	2·08	5	0·77	4·58
Gisborne	4·19	15	0·94	5·07
Taupo	2·78	7	1·13	3·91
Napier	3·53	15	1·11	3·82
Hastings	2·95	14	0·79	3·69
Taihape	1·31	13	0·26	3·04
Masterton	2·47	16	0·61	4·24
Patea	1·49	11	0·71	4·33
Wanganui	0·84	5	0·48	3·40
Foxton	0·72	4	0·60	3·24
Wellington	1·48	14	0·67	4·71
South Island.				
Westport	1·94	12	0·64	8·30
Greymouth	2·54	8	1·11	8·03
Hokitika	1·79	8	0·67	8·87
Ross	2·87	6	1·20	9·46
Arthur's Pass	3·41	5	1·60	10·33
Okuru	4·41	6	1·27	10·77
Collingwood	1·69	6	0·75	9·88
Nelson	0·35	3	0·23	3·52
Spring Creek	0·47	5	0·21	3·55
Hanmer Springs	2·48	8	0·87	4·44
Highfield, Waiau	1·99	4	0·73	3·37
Gore Bay	1·50	8	0·52	2·87
Christchurch	1·65	15	0·34	2·69
Timaru	1·04	7	0·41	1·90
Lambrook Station, Fairlie ..	1·77	4	0·90	2·65
Benmore Station, Clearburn ..	0·08	4	0·05	1·79
Oamaru	0·67	6	0·25	1·74
Queenstown	0·09	4	0·05	2·06
Clyde	0·14	2	0·08	0·92
Dunedin	2·77	17	0·63	3·01
Wendon	0·77	8	0·16	1·81
Gore	1·57	17	0·33	1·96
Invercargill	3·49	19	0·68	3·28
Puysegur Point	3·36	20	0·70	6·19
Half-moon Bay	4·34	22	0·85	4·41

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

WASHING OUT COWS AFTER CALVING.

"SUBSCRIBER," Ashhurst :—

Would you kindly advise me of a suitable disinfectant for washing cows after calving; and is it necessary to wash all cows.

The Live-stock Division :—

The necessity of washing out cows after calving will depend upon each individual animal. If the cow has calved normally at full time with no complications, such as dead calf or retained afterbirth, there is no necessity for washing out the animal. In such cases washing out may be actually detrimental and set up unnecessary irritation. Cows affected with a retained afterbirth, giving birth to a dead calf, or any other complication likely to result in infection of the womb and a chronic discharge therefrom, require to be washed out after calving and treated in such a manner as to prevent a lasting inflammation of the womb. The rubber tubing and other appliances used should be thoroughly washed and scalded before use. The washing-out should be carried out in a hygienic manner, the object being to assist the natural forces of the body to overcome the infection. For this purpose a mild antiseptic solution should be used; strong solutions actually cause irritation and aggravate the condition it is intended to relieve. The water used for preparing the antiseptic solution should be clean water, boiled and allowed to cool before use. The solution should be used at blood-heat. A suitable antiseptic solution may be prepared by adding 1 oz. of Lugol's solution of iodine to a gallon of water prepared as above stated. A hygienic measure which can be commended for all cows is to wash the root of the tail free from all foreign matter and discharge a few days after calving. An ordinary soapy solution may be used in this case.

INOCULATION AND TOP-DRESSING FOR LUCERNE.

"SUBSCRIBER," Kurow :—

I wish to inoculate the soil when sowing an area in lucerne, and will be obliged for information as to the best means of doing so, and the approximate cost per acre. Also is it advisable to top-dress old stands of lucerne with super?

The Fields Division :—

Inoculation for lucerne is best carried out by treating the seed before sowing with a specially prepared culture. This culture is procurable from the Department at the following rates: 2s. per bottle sufficient for 30 lb. of seed, 4s. for 60 lb., 6s. for 90 lb., 8s. for 120 lb. Assuming that you sow at the usual rate of 15 lb. per acre, the cost works out at 1s. per acre. Old stands may be top-dressed to advantage with 3 cwt. per acre of superphosphate in the spring just as the growth of lucerne is beginning, so as to give the lucerne maximum stimulation and avoid as far as possible stimulating grasses and other weeds which possibly are present.

CHECKING INDIAN DOOB GRASS IN LAWN.

FRANK J. REYNOLDS, Whakatane :—

My lawn has become very thick with Indian Doob twitch-grass. I do not wish to break up the lawn. Which do you consider is the best means to check the twitch growth and encourage the lawn grasses?

The Horticulture Division :—

The best treatment for your lawn will probably be to rake it well and break up the mats of Indian Doob. Remove the detached litter and mow the lawn; then apply a top-dressing of the following mixture, which will encourage the growth of the better grasses: 2 oz. bonedust, 1 oz. superphosphate, 1 oz. sulphate of ammonia, ½ oz. sulphate of potash, per square yard. It should be mixed before application with twice its weight of sifted sand or good soil.